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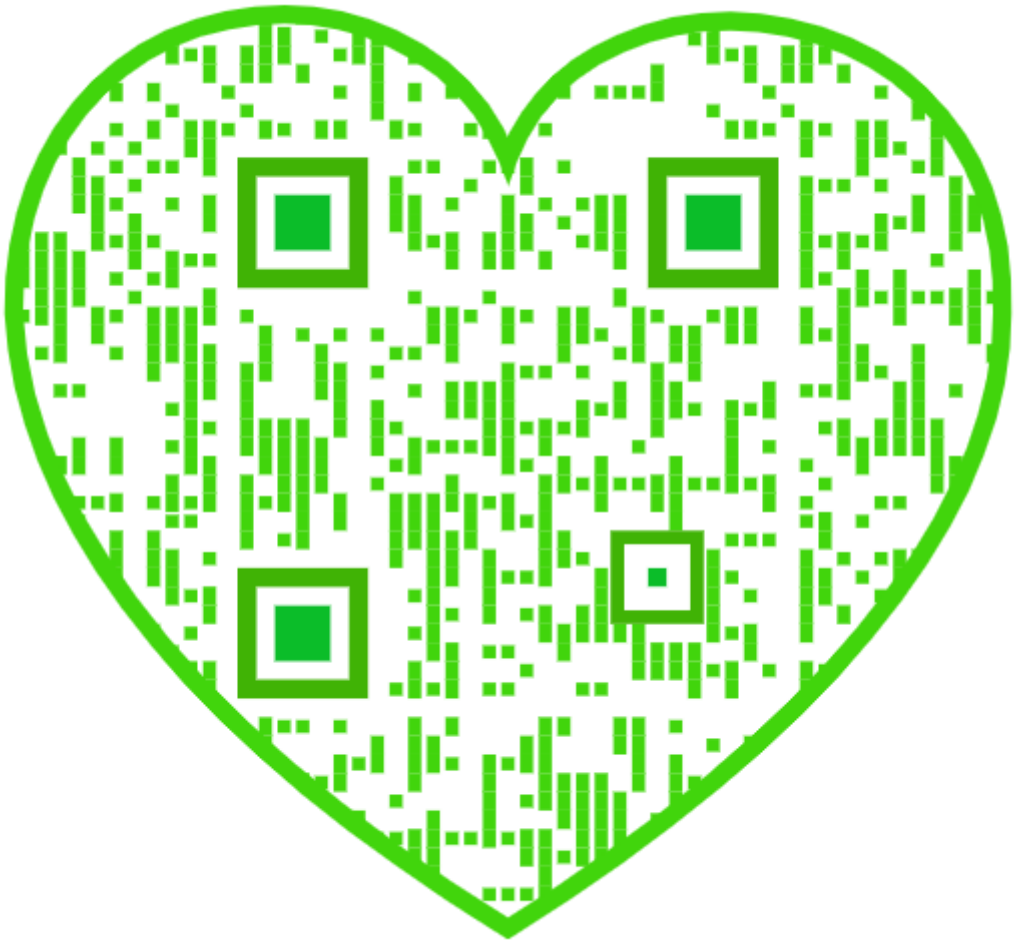

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INDEX
MUNICIPAL ENGINEERING

E.—Editorial Comment. Q.—Question Department. I.—Current Information.
M.—Machinery and Trade. W.—From Workers in the Field.

Accounting, Costs and Contracting Practice. E. 125
American Association for Standardizing Paving Specifications, The..... 488
American Road Builders' Convention.... 486
American Society of Municipal Improvements 394
Asphalt, Cost of Macadam and Asphalt Paving. Q. 43
Asphalt Paving, Books on. Q. 44
Asphalt Paving in Milwaukee, Reduction in Cost of. Q. 48
Asphalt Pavement, Another Machine for Mixing. W. 375
Asphalt Paving Materials, Concrete Mixers for. Q. 211
Asphalt Pavement, Standard Tests for Asphaltic Cement for. By James W. Howard, New York City..... 342
Asphalt Plant. Municipal. Q. 374
Asphalt Paving Plant, A Portable. M.. 407
Asphalt, Rock, Street with Continuous Asphalt Surface. W. 215
Assessment Maps, Method of Maintaining and Correcting. W. 292
Austin Dam, Failure, Needed Investigations of. E. 456
Automobile Traffic and the Road. M.. 155

Barrington, R. I. Experimental road.. 439
Bitucrete. W. 376
Bitulithic in California. M. 154
Bitulithic Patents, Michigan, Decisions on. L. 379
Bitulithic Pavement, Durability of. Q.. 43
Bituminous Concrete Pavement. By H. B. Lykken, of Grand Forks, N. D..... 345
Bituminous Concrete Pavement. By George C. Warren, Boston, Mass..... 349
Bituminous Paving Mixtures, Manipulation in Analyzing. Q. 130
Bituminous Road Builders, Portable Plant for. M. 154
Bituminous Road Material, Methods of Distillation. Report of Committee to American Society for Testing Material. 190
Bituminous Road Material, Standard Tests for. By Logan Waller Page, Washington, D. C. 110
Bituminous Road Materials, The A. P. Spreader For. M..... 374
Bituminous Surfaces for City Macadam Streets. By J. C. Travilla, St. Louis, Mo. 285
Bituminous Wearing Surface for Concrete Pavement. W. 215
Blueprint, How to Treat Overprinted. Q. 373
Books for Engineers..... 481
Books on Accounting for Contractors. Q. 129
Books on Asphalt Paving. Q. 44
Books on Concrete Construction. Q.... 128
Books on Gas Construction. Q. 45
Books on Water Rates and Water Works Management. Q. 291
apolis, Ind. 338
Boulevard Improvements in Chicago.. 144
Brick Pavements, Bituminous and Cement Fillers For. W. 51
Brick Pavement, Note and Queries on Grouted and Sand-Filled. By Maury Nicholson, Birmingham, Ala. 269
Brick Pavement, Contraction and Expansion of. By Will P. Blair, Cleveland, O. 272
Brick Rattler, The Standard. 403
Brick Road Construction About Cleveland and Buffalo..... 364
Brick Road, Transverse Expansion Joint in. W. 49
Brick Sewer in Newark, N. J., Rebuilding an Old. By Edward S. Rankin, Newark, N. J. 284
Brick with the Mathews Gravity Carrier, Laying. M. 232
Budget Exhibit, New York..... 312
Bureaus of Municipal Efficiency..... 309
Bus Transportation, Motor..... 476

Calcium Chloride in Road Construction 401
Calcium Chloride, Dust Prevention With 313
Canal for Buffalo, N. Y., A Sanitary and Power. W. 376
Carrier, Laying Brick with the Mathews Gravity. M. 232
Catch Basins and Sewers, Cleaning by Pump. Q. 43
Cement Industry in 1910, The. M. 158
Cement Plant, A New Portland. W. .. 216
Cement Testing Machine of Maryland, Geological Survey. W. 293
Cement Workers, Patents on Apparatus and Tools for. M. 160
Chara, A Water Purifying Plant..... 301
City Planning, The Relation of Technical Men to. 453
City Planning in Vienna..... 21
Civic Association, The American..... 488
Commission Government in Trenton, N. J. 313
Conduit System, A New Electric..... 306
Concrete Base for Steam Railroad Track. W. 132
Concrete Block, The Fisher. M. 408
Concrete Culvert, Collapsible Forms for. M. 406
Concrete Construction, Books on. Q... 128
Concrete Dump Bucket, A New Controllable. 491
Concrete for Street Paving, Mixing. W. 50
Concrete Foundation under Steam Railway Track..... 52
Concrete Mixers in Chicago, The Eclipse.. 492
Concrete Pavements, Bituminous Wearing Surface for. W. 215
Concrete Pavement with Bituminous Wearing Surface. W. 376
Concrete Poles, Cities Using Reinforced. Q. 374
Concrete Sidewalks, Steel Forms for. M. 324
Concrete Walk, Metal Monuments In. Q. 212
Congress and Exposition, The Municipal 315
Contract, Competition in Public. W. .. 136
Contracts, Competition in Public. E. . 205
Contracts, Competition in Public. E... 39
Contract for Indefinite Period Cannot Be Made By City Council..... 297
Contracts for Public Improvements, Letting. W. 213
Contracting Practice, by DeWitt V. Moore, Indianapolis, Ind.....
.....1, 93, 174, 253, 337
Contracting Practice and Costs Accounting. E. 125
Contraction and Expansion of Brick Pavement, By Will P. Blair, Cleveland, O. 272
Contraction and Expansion in Wooden Block Pavement. W. 294
Contractors, Books on Accounting for.. 129
Contractor, Delay of C. in Beginning Work. Q. 44
Contractors' Power Pump. M. 402
Cost Distribution, Labor, Pay Roll System. By DeWitt V. Moore, Indianapolis, Ind. 337
Crosby, W. W., Baltimore, Md., Problems of Road Construction..... 447
Crusher, The Jeffrey Single Roll. M... 323

Curb and Gutter and Pavement Measurements. Q. 210
Culverts, Collapsible Forms for Concrete. M. 406
Curve Resistance to the Flow of Liquids, A Theoretical Formula for, By Philip J. Markmann, St. Louis, Mo... 263

Dam Failure, Needed Investigation of Austin. E. 456
Decisions of the Higher Courts.....
.....140, 217, 296, 378, 462
Depreciation in Cast Iron Pipe. Q. ... 211
Distillation of Bituminous Road Material. Report of Committee to American Society for Testing Material.... 190
Drainage Ditches, How to Prevent Silting of. Q. 130
Drainage of Flat Streets. Q. 46
Dust and Its Prevention on City Streets. By Prof. Arthur H. Blanchard, Providence, R. I. 114
Dust Prevention and Road Preservation, Experiments in. I. 146
Dust Prevention with Calcium Chloride 313
Dust Preventive, English Use of Tar as a..... 63
Dust Problem in Great Britain. I. 144

Edy. John M., Billings, Mont., Practical Road Building..... 432
Electric Plants, Milan's Municipal..... 65
Electric Lighting Station for Small Towns, Equipment of, By Carl D. Hoskins, Schenectady, N. Y..... 450
Electric Lighting System, Investment in Small. Q. 43
Electric Station Power Rates and Economy, Central. W. 52
Electrolytic Treatment of Sewage at Oklahoma City..... 460
Engineering Exhibition at Baku..... 478
Engineering on Good Roads, Cost of. Q. 290
Engine, The Atlas Crude Oil..... 491
Ethics for Consulting Engineers, A Code For..... 310
Expansion and Contraction of Brick Pavement, by Will P. Blair, Cleveland, O. 272
Expansion and Contraction in Wooden Block Pavement. W. 294
Expansion Joint in Brick Road, Transverse. W. 49

Fillers for Brick Pavements, Bituminous and Cement. W. 51
Filtration Plant at Toronto, Ontario, The Water..... 445
Financing of Public Utilities. By Robert J. Graf..... 203
Fire Apparatus, Automobile Chemical, at Horristown, Pa. M. 321
Fire Apparatus, Automobile..... 300
Fire Apparatus, Motor. By Louis Vehrers, Charleston, S. C..... 222
Fire Apparatus, A New Motor Drive for 229
Fire Apparatus, Motor Propelled, by Louis Almgren, Jr., chief of the fire department of San Diego..... 59
Fire Apparatus, the Boyd Automobile. M. 157
Fire, Consumption of Water in Bangor 302
Fire Department, Improvements of Boston 303
Fire Department Extension Proposed in New York..... 312
Fire Department, A European (Hamburg) 58
Fire District for Boston, A Metropolitan 303
Fire Engineers, International Association of..... 397
Fire Hose, Specifications for 59
Fire Protection by Gas Engines..... 29
Fire Steamers and Automobile Fire Engines, Comparative Tests of..... 300
Flow of Liquids, A Theoretical Formula for the Curve Resistance to. By Philip J. Markmann, St. Louis, Mo. 201-263
Forms, For Concrete Sidewalks, Pressed Steel. M. 324
Formula for the Curve Resistance to the Flow of Liquids, A Theoretical. By Philip J. Markmann, St. Louis, Mo. 201
Franchise Ordinance of Los Angeles... 306
Freight Transportation Within City... 310

Garbage Collection and Disposal, Information About. Q. 291
Garbage Disposal in Montclair, N. J. I. 147
Garbage Incinerator and Steam Generator, A Municipal. M. 405
Garbage Plant, Cleveland, to Exhibit. I. 147
Garbage Plant at Paterson, N. J..... 483
Garbage Problem, The Pittsburg. G... 61
Gas Company's Stock at Premium, 60-Cent 303
Gas Construction, Books on. Q. 45
Gas Engines, Fire Protection by..... 29
Gas Plant, Profit Sharing in Municipal.. 475
Gas Plant, A Small Town..... 493
Gas Producers and Gas Pumping Plant at Manchester, Mass. M. 229
Gas Rates in Chicago. E. 206
Gas Rates in Chicago..... 228
Gas Rate in Milwaukee Reduced..... 225
Gas Supply of Manchester, Eng., Municipal 225
Gas Undertaking, British..... 305
Grades, Best Pavement for Steep. W.. 460
Grades, Street, In Small Cities. Q..... 458
Gravel, Screened vs. Pit Run..... 460
Grand Rapids, Mich., Municipal Water Purification Plant. By J. W. Armstrong, New York City..... 429
Gutter for Steep Dirt Road. Q. 289

Highway Engineering Instruction at Columbia University..... 152
Highway Improvements, The American Association For.150, 226, 288, 314, 369, 484
Highway Laws of Pennsylvania..... 466
Highways in England..... 112
Highways, The Modern in Allegheny County, Pa. I. 145
Highway Organization, The Ohio State 276
Highways, State..... 304
Home Rule, Central Utilities Commission and. E. 369
Housing, The Garden City Movement in England..... 310

Ice Plant, Water Works and Electric Light at Loveland, O. By Frank P. Perkins, Buffalo, N. Y..... 198
Illuminating Engineering Society..... 316
Illumination of Streets and Open Places, The. By E. Darrow, consulting Engineer..... 34
Improvement, Authority to Expend Money For. Q. 373
Improvement and Contracting News....
.....111, 161, 257, 326, 412, 495
Incinerator, The Harris Garbage Incinerator and Steam Generator. M... 405
Incinerator, The Milwaukee Refuse. I. 148
Inspector's Notes on Sewer Work. Q.. 130

Johns-Manville Bldg., The..... 306

Laundry, Cincinnati's Municipal..... 480
Lead Wool for Jointing Water Pipe. M. 154
League of American Municipalities....
.....227, 312
Lewis, Nelson P., New York City. Adaptation of Roads and Pavements to Local Conditions..... 426
Light, The Development of Electric.... 472
Light in Hastings, Ornamental. I..... 146
Light Plant at Holland, Mich., Municipal Electric..... 305
Light Plant, Sharon, Pa. Contemplates a Municipal..... 471
Light, Peoria, Ornamental. M. 236
Light in Pittsburg, Municipal. I. 146
Light, Water Works and Ice Plant at Loveland, O. By Frank P. Perkins, Buffalo, N. Y..... 198
Lighting, Investigation of Lansing Street. I. 146
Lighting, Ornamental Street..... 305
Lighting Rates for Johnstown and Gloversville, N. Y..... 305

Lighting Standard, The Corinthian, Chosen by Government. M. 408
Lighting Stations for Small Towns, Equipment of. By Carl D. Hoskins, of Schenectady, N. Y. 450
Lighting in Warren, O., Ornamental
Los Angeles, Municipal Power Plant Recommended For 475
Los Angeles Refuse Disposal 480
Street 400

Macadam Roads in California. I. 143
Macadam and Asphalt Paving, Cost of. Q. 43
Manufacturers Export Association, The 316
Manufacturers Seeking Change in Location. Q. 43
Maps, Method of Maintaining and Correcting Assessment. W. 292
Maps of Underground Structures. Q... 373
Market, Des Moines, Municipal 309
Mason City, Ia., Paving in 461
Methylene Blue, Sewage Tests With. Q. 373
Milwaukee, Free Legal Aid in 465
Mixers for Asphalt Paving Materials, Concrete. Q. 211
Monuments, Metal Set in Concrete Walks. Q. 212
Contracting Practices 421
Municipal Congress and Exposition, The 151, 315
Municipal Efficiency Bureaus 309
Municipal Government in Europe, Forms of. By Robert W. Speer, Denver, Colo. 256
Municipal Improvements, American Society of 226, 288, 394

MUNICIPAL MATTERS IN COURT.

Decisions of the Higher Courts of Interest to Municipalities.

Advertisement for Bids is Regular, Contracts Not Legal Unless The.. 217
Appraisal is not entitled to Compensation for Dilatory Work, Board of 463
Assessed Improvement Work, City Responsible for 464
Assessing for Sidewalks Within Street Intersection Area. Q. 458
Assessments for Public Improvements 140
Assessment for Public Sewer may Not be Vacated by Reason of Private Sewer 218
Assessment of Cost of Repaving a Street May be Made 218
Assessment, Trespass Does Not Invalidate Sewer 218
Assessment, Partially Invalid 296

Barriers, City must not protect grass plot by injurious 464
Bathing in Public Water Supply 218
Bidding by Councilmen on City Work constitutes Fraud 56
Blueprints, Remedies for Overprinted. Q. 459
Board of Works, Power Of 296
Bond Election void if its different questions are not separately stated 464
Bonds, Different Bonding Questions Must be Submitted Separately 217
Bond, Advance Payment on Construction Contract does not Relieve Surety 378
Bonds for Acquiring Public Utilities, Rights of Cities to Issue. L. 56
Bridge is Street Improvement, Reconstruction of 219

Channel for water supply, City must maintain adequate 464
City Buying Land for a Street, Rights of a. L. 55
City not Liable for Debts of Condemned Water Company insurred in process of Acquiring Company.. 55
Condemnation Proceedings, Damages on, Must be Prepaid 463
Condemnation of Property for Water Works 141
Condemnation of Land, Damages For 141
Condemnation. Lands May Be Appropriated By Ordinance 219
Contract. A Water Company's Charter Constitutes A 140
Contract is Let. Substitution in Specifications by Authority of an Official May Not be Made After 140
Contract, City Not Liable for Loss Under a Rescinded 140
Contracts Not Legal Unless Advertisement for Bids is Regular 217
Contract Does Not Relieve on Surety Bond, Advance Payment on Construction 378
Contracts Invalidates Tax Bill, Unreasonable Delay in Paving 218
Contract With City For Indefinite Period Can Be Voided 218
Contract Work, Liability For Excessive Part Payment On 296
Contract, What May Be Included in Sidewalk 219
Contract, Extras Must Be Paid When Provided In 462
Contractor Not Responsible For Injuries if Warning Signs are Stolen 463
Contractor's Cook is Not Connected with Work 463
Contractor, Pavement Guarantee Does Not Give Sole Right to Repair to.. 56
Contractor Under Pavement Guarantee, Liability of 56
Contractor, City Not Liable for Delaying 55
Contractor's Indebtedness, City Not Responsible For 296
Corporation Fined for Obstructing River 465
Counsel, City May Employ Associate 141
Councilman Ousted for Cause, May be Re-elected 462
Damages for Condemned Land 141
Damages, Value of Improvement May Not be Credited Against 297
Discriminate in Supplying Service, Corporation May Not 296

Election Void if Its Different Quesare Not Separately Stated, Bond.. 464
Engineering on Good Roads, Cost Of 460
Excavations Under Sidewalks, Maintenance of 56
Extras Must Be Paid When Provided in the Contract 462

Fire Damages Cannot be Obtained on Basis of Low Water Pressure 463
Fire Protection, Right of an Individual to 56
Fireworks Set Off Under Authority, City Not Liable For 217
Franchise Constitutes Alternative Courses of Action, Right to Purchase and Renewal Privilege of a. 463
Franchise, Continuation of the Right 55
Franchise, Right to Tap City Water Mains Is Not a 141
Franchise of Water Company Constitutes a Contract 140

Grade is Changed, Petition Necessary Before Street 463

Health Regulations, Validity of 218
Highway, Collection of Damages for Improper Use of 465

Improvements, Benefit of, May be Decided by Board of Works 296
Indebtedness Invalidated Purchase of Water Works, Attempt to Evade Limit of 378
Indebtedness, Water Rentals May Exceed Limit of 296
Indebtedness, City Not Responsible for Contractor's 296
Intersection Area, Who Should be Assessed for Sidewalks Within Street 458
Laundry Waste Is a Nuisance 378
Liabilities of Contractors Cease with

Acceptance of Work..... 297
Liability of Street Railway Company for Sprinkling Streets..... 55
Liability of Contractor Under Pavement Guaranty..... 56
Liability of City for Work by Independent Contractors..... 140
Liability of City for Unforseen Accidents Due to Natural Causes..... 141
Liability of City for Water Supply.. 379
Liability for Injury from Fireworks Set Off Under Authority..... 217
Liability for Negligence in Sewer Construction 217
Liability of City for Contractors' Indebtedness 296
Liability of City for Small Defects in Sidewalks..... 296
Liability for Excessive Part Payment In Contract Work..... 296

Meters. What Determines the Right to Unmetered Water..... 379
Meters, Right of Water Company to Install 217
Municipality Not Dissolved by Military Occupation 140

Ordinance, Lands May be Condemned by 219
Ordinance Must be Specific, Sidewalk 218

Patented Materials Do Not Limit Competition in Paving Award..... 142
Paving Award, Use of Patented Materials Does Not Limit Competition 142
Pavement Guarantee, Liability of Contractor Under..... 56
Public Improvements Must be Determined by Municipal Officers, Cost of..... 464
Public Service Commissions Upon Securities Operating Thereunder, The Effect of..... 461
Public Utilities, Rights of Cities to Issue Bonds for Acquiring..... 56
Purchase and Renewal Privilege of a Franchise Constitutes Alternative Courses of Action, Right to... 463

Rates, Rights of a Municipality in Fixing Water..... 57
Rate Reduction, The City Has No Right to Enforce Public Service... 141
Rental of a Tenant, Owner Not Liable for Water..... 462
Repaving Street May Be Assessed, Cost of..... 218
Rights of a Dismissed Appointive Officer 55

Service, Utilities Corporation May Not Discriminate in..... 296
Sewer Construction, Liability for Negligence in..... 217
Sewer, Not Ground for Vacating Assessment for Public Sewer, Private 218
Sidewalks, Maintenance of Excavations Under..... 56
Sidewalks, City May Locate Manholes in..... 140
Sidewalk Contract, What May be Included in..... 219
Sidewalks, Liability of City for Small Defects in..... 296
Specifications, Notice Required Concerning Things in..... 297
Specifications by Authority of Official May Not be Changed After Contract is Let, Substitution in..... 140
Specifications, City Not Responsible for Misinterpretations..... 142
Specifications, Water Works Must Meet 378
Sprinkling Streets, Liability of Street Railway Company for..... 55
Stream so as to Cause Injury to Property of Others, Individual May Not Obstruct..... 56
Street Grades for Public Necessity, The Right to Change..... 55
Street Railway Company for Sprinkling Streets, Liability of..... 55
Street, Right of a City Buying Land for a..... 55
Streets, Rights of a City to Vacate.. 55
Street Sewage from Water Appliances and Laundry is a Nuisance.. 378
Street, What Determines the Lay Out of..... 378
Street Railways by City, Regulation of 218
Street Railway Company Cannot Retain Unused Track..... 219

Tax Bill, Unreasonable Delay in Paving Contracts, Invalidates..... 218
Tracks, Street Railway Company Cannot Retain Unused..... 219
Trespass Does Not Invalidate Sewer Assessment 218
Trespass. Property Owners Consent Necessary to Install Drains..... 296

Waste Is Reasonable, Regulations to Prevent Water..... 462
Water, Municipality is Liable for Damage due to Diverted..... 463
Water Works is not a Governmental Function of the City, Maintenance of a..... 57
Water Appurtenances on Property, Property Owner Responsible for... 297
Water Companies May be Taxed to Support a Municipal Plant, Private 462
Water Company incurred in Process of Acquiring Company, City Not Liable for Debts of Condemned.... 55
Water Company May Refuse Service for Non-Payment..... 141
Water Company to Install Meters, Right of..... 217
Water Course, Corporation fined for Obstructing 465
Water Mains is Not a Franchise, Right to Tap City..... 141
Water Pressure, Fire Damages Cannot be Obtained on Basis of Low.. 463
Water Rates, Rights of a Municipality in Fixing..... 57
Water Rental of a Tenant, Owner Not Liable for..... 462
Water Rentals May Exceed Limit of Indebtedness 296
Water, Right to Unmetered, What Determines 379
Water Supply, City Must Maintain Adequate Channel for..... 464
Water May Not be Supplied Outside of City Limits..... 140
Water Supply Plans Must be Submitted to State Board in New Jersey 297
Water Supply, City Not Liable for... 378
Water Waste Is Reasonable, Regulations to Prevent..... 462
Water Works, Right of Municipality to Condemn Property for..... 141
Water Works Purchase Invalidated by Attempt to Evade Debt Limit.. 296
Water Works Must Meet Specifications 378

Municipal Ownership in Birmingham, Eng. 308
Municipal Ownership in Wheeling, W. Va. 380
Municipal Ownership in Toronto..... 471
Municipal Power Plant Recommended for Los Angeles..... 475
Municipal Railway, Calgary's. I. 149

Odors, Sewage Disposal with Respect to Offensive. By George W. Fuller. 27, 116
Ohio State Experimental Road..... 179
Ohio State Experimental Road..... 286
Ohio State Highway Organization..... 276
Oklahoma City, Water Works Problem Settled 483
Parks, Title to Recorded Reservations for, Q. 46
Patents on Apparatus and Tools for Cement Workers. M. 160

Patents on Road and Pavement Construction, and Repair. M. 410
Patents on Water Proofing Concrete. M. 160
Paterson, N. J., Bids for Garbage Plant at 483
Pavement and Curb and Gutter Measurements. Q. 210
Pavement in Chicago, Repairing Asphalt 478
Pavements Best for Steep Grade. W... 214
Pavement, Bituminous Concrete. By H. B. Lykken, of Grand Forks, N. D. 345
Pavement, Bituminous Concrete. By Geo. C. Warren, Boston, Mass..... 349
Pavement, Concrete with Bituminous Wearing Surface. W. 376
Pavements, Concrete for Bituminous Wearing Surface. W. 215
Pavement, Contraction and Expansion in Wooden Block. W. 294
Pavement Construction and Maintenance, Distributing and Mixing Machinery for. By Arthur H. Blanchard, New York City..... 354
Pavement, Contraction and Expansion of Brick. By Will P. Blair, Cleveland, O. 272
Pavement, Discussion of the Best Form. By J. C. Travilla, St. Louis, Mo. 194
Pavement, Durability of Bitulithic. Q. 43
Pavement, Notes and Queries on Grouted and Sand-Filled Brick. By Maury Nicholson, Birmingham, Ala..... 269
Pavement, Proposed Method of Treating Block for Wooden. W..... 375
Pavements and Roads to Local Rural Conditions, Adaptation of. By Nelson P. Lewis, New York City..... 426
Pavement, Standard Tests for Asphaltic cement for Sheet Asphalt. By J. W. Howard, New York City..... 342
Pavement for Steep Grade. W..... 135
Pavements, The Width of Street. I. The Influence of Sub-structures. By George S. Webster, chief engineer, Philadelphia, Pa. II. The Influence of Surface Conditions. By George W. Tillson, consulting engineer, Borough of Brooklyn, N. Y..... 31
Paving Investigation, Chicago. E..... 126
Paving Mixtures, Manipulation in Analyzing. Q. 130
Paving, Mixing Concrete for Street. W. 50
Paving Specifications for Wood Block. Q. 374
Pennsylvania Highway Laws..... 466
Personal Notes.....153, 228, 318, 399, 489
Pipe, Depreciation in Cast Iron. Q.... 211
Pipe, Steel and Cast Iron. By Allen Hazen, consulting engineer, New York City 9
Planning, The Relation of Technical Men to City..... 453
Pneumatic Pumping Plant at Shirley, Ind., An Automatic..... 278
Pollution of Streams by Manufacturing Waste. By William S. Johnson, New York City..... 197
Posts, California, Concrete Ornamental.. 475
Power Plant of Richmond, Va., The Municipal 434
Profit Sharing in Municipal Gas Plant... 475
Public Service Industries in Wisconsin, Field Inspection of. By J. H. Roemer, Madison, Wis..... 282
Public Service Commissions Upon Securities, of Companies Operating Thereunder, The Effect of. E..... 455
Public Utility Commissions. Causes and Effects of. By J. H. Roemer, Madison, Wis. 112
Pump, The Harold L. Bond, Contractors' Power. M..... 402
Pumping Plant at Shirley, Ind., An Automatic Pneumatic..... 278

Quick Sand, Foundation for Sewer in. Q. 210
Railroad Electrification. St. Louis, A Report on..... 307
Rates in Small Cities, Water. Q..... 131
Rates, Books on Water and Water Works Management. Q..... 291
Rates and Economy, Central Electric Station Power. W..... 52
Rates for Gas in Chicago..... 228
Rates for Gas in Chicago. E..... 206
Rate for Gas in Milwaukee Reduced... 225
Rates for Lighting Johnstown and Gloversville, N. Y..... 305
Rattler, The Standard Brick. M..... 403
Reinforced Concrete Floor. Q..... 42
Refuse Disposal, New York's Economical 33
Refuse Disposal in Gerlin, Germany.... 476
Refuse Disposal in Los Angeles..... 480
Refuse Incinerator, Milwaukee. I..... 148
Refuse and Sewage, Disposal of. Q... 289
Repairing Asphalt Pavement in Chicago. 478
Richmond, Va., Municipal Power Plant 434
Road Surface and the Automobile. M.. 155
Road Building, Practical. By John N. Edy of Billings, Mont..... 432
Road Builders' Convention, The American 486
Road Construction about Cleveland and Buffalo, Brick..... 364
Road Construction, Problems of. By W. W. Crosby, of Baltimore, Md..... 447
Road Construction with Calcium Chloride 401
Roads, Cost of Engineering on. Q.... 290
Roads, Cost of Engineering on Good... 460
Roads, The Dust Problem in Great Britain's. I. 144
Road, Gutter for Steep Dirt. Q..... 289
Roads, Macadam, in California. I..... 143
Road Machinery and Material Manufacturers, National Association of..... 491
Road Materials, The A. P. Spreader for Bituminous. M. 324
Road Roller, Motor. M..... 320
Roads, Their Care and Repair, Country. W. 51
Road Preservation and Dust Prevention, Experiments in. I..... 146
Road, Recent Progress in the Good Roads Cause..... 468
Road, Recent Progress in the Good Roads Cause. Mississippi to New Mexico... 468
Road Work, Spreading Dump Cars for. M. 404
Road Work, The Eclipse Concrete Mixer on Bituminous. M..... 405
Roads and Pavements to Rural Conditions, Adjutation of. By Nelson P. Lewis, New York City..... 426
Roads, Recent Progress in Good Roads Cause 382
Road, Proposed Interstate..... 224
Road, The Barrington, R. I., Experimental 439
Roads in New Jersey and Their Repair. By James Owen, Newark, N. J. 352
Roads in South Georgia, Good. I..... 145
Road, The Ohio State Experimental... 179
Road, The Ohio State Experimental... 286
Road Improvements in Eastern Pennsylvania, National..... 382
Road Improvement in the States from Alabama to Minnesota Inclusive..... 382
Road Congress of American Association for Highway Improvements at Richmond, Va. 392
Road Builders Association Meeting at Rochester, N. Y., American..... 397
Road Building in Venzuela..... 313
Road Builders' Association, The American 316
Rochester's Street Improvement Record 468
Roller, The Buffalo Pitts..... 492
Ruddle or Natural Chalk. Q..... 373

Sanitary Regulation, Power of the State to Control Use of Property By..... 298
Scale and Truck Order, Large. M..... 319
Sewage Disposal with Respect to Offensive Odors. By George W. Fuller, New York City.....27, 116, 192

Sewage, Disposal of Single House. Q... 42
Sewage Disposal in Bowling Green. I. 149
Sewage Disposal Plant, Small. Q..... 373
Sewage Ejectors, Electric. M..... 235
Sewage Ejector. M..... 406
Sewage and Refuse, Disposal of. Q... 289
Sewage, A Rotary Sieve for. By Robert Grimshaw, Dresden, Germany..... 275
Sewage Solids, Disintegrator for. Q... 373
Sewage Tests Methylene Blue. Q..... 373
Sewage at Oklahoma City, Electrolytic Treatment of..... 460
Sewage Treatment, Who Supplies Chloride of Lime for. Q..... 48
Sewer in Quicksand, Foundation for. Q. 210
Sewer in Newark, N. J., Rebuilding an Old Brick. By Edward S. Rankin, Newark, N. J..... 284
Sewers, Cleaning Catch Basins and by Pump. Q..... 43
Sewer Construction, Liability for Negligence in..... 217
Sewer Computation Diagrams. M..... 319
Sewer Computation Diagram, Explanation of. Q..... 459
Sewer Connections, Right of City to Charge for. Q..... 44
Sewer Joints, Jute in. Q..... 48
Sewer Joint, A Flexible Water-tight. M. 233
Sewer Scrubber and Scraper. By Dr. Robert Grimshaw, Dresden, Germany.. 196
Sewer System Constructed at Grand Junction 312
Sewer, Size of Branch of Sanitary. Q.. 44
Sewer Work, Inspector's Notes on. Q.. 130
Sewerage Plans of Ligonier Approved.. 311
Specifications, Where to Obtain Standard. Q. 44
Specifications, Standardizing. E..... 370
Sprinkling Street in Denver, Colo..... 115
Standardizing Specifications. E..... 370
Standardizing Paving Specifications, The American Association for..... 488
Steel, Non-Corrosive Sheet. M..... 157
Streams, Illinois Law for Straightening. Q. 212
Streets, Bituminous Surfaces for City Macadam. By J. C. Travilla, St. Louis, Mo. 194
Street Cars, Systems of Marking..... 63
Street Cleaning Machinery, The Menzies. M. 404
Street Cleaning, An Automatic Dump Cart for. M..... 408
Street, How to Compute Excavation for Grading. Q..... 48
Streets, Drainage of Flat. Q..... 46
Streets, Dust and Its Prevention on. By Prof. Arthur H. Blanchard, Providence, R. I. 114
Streets on Hills, Breaking Grades of. Q. 47
Street Illumination, Investigation of Lansing. I..... 146
Street Improvement Record of Rochester 468
Streets and Open Places, The Illumination of. By E. Darrow, Consulting Engineer 34
Street Lighting, Ornamental..... 473
Street Lighting in Vancouver..... 474
Street Lighting in New Zealand..... 472
Streets, Movement to Prevent Injury to.. 382
Street Railway, Winnipeg Contemplates Owning 307
Street Railways—Report of St. Louis United Railways Investigating Committee 64
Street Signs in London..... 480
Street Sprinkling in Denver, Colorado... 115
Street Sweeping Machine, A Foreign (Vienna). G. 61
Subways, Term of Lease for Boston..... 200
Silting of Drainage Ditches, How to Prevent. Q. 130
Sludge, Disposal of and Removal of Suspended Matter in Sewage. By Geo. W. Fuller, New York City..... 192
Smoke, International Association for the Prevention of 150
Tar and Oil Spraying Machine, The Johnston. M. 321
Tar as a Dust Preventive, English Use of. 63
Technical Associations.151, 227, 317, 397, 489
Technical Schools.....153, 317, 398, 488
Toronto, Ont., The Water Filtration Plant at 445
Track, Concrete Base for Steam Railroad. W. 132
Trade Notes. M....111, 160, 236, 325, 409
Trade Publications. M....159, 235, 325, 408
Turbine Driven Pumps, Comparative Tests of Engine and. M..... 320

Utilities, Financing of Public. By Robert J. Graf..... 203
Waste, The Pollution of Streams by Manufacturing. By William S. Johnson, New York City..... 197
Waste of Water in Buffalo, N. Y..... 102
Waste of Water in Memphis, Tenn., Investigations of. By Carl E. Davis.... 104
Water in Bangor Fire, Consumption of.. 302
Water in Buffalo, N. Y., Waste of..... 102
Water Cooler, A Power. M..... 319
Water Filtration Plant at Toronto, Ont.. 445
Water, Investigations of Waste of, in Memphis, Tenn. By Carl E. Davis... 104
Water Meter, Who Has Control of. Q.. 45
Water Meter, The Simplex. M..... 156
Water Pipe, Lead Wool for Jointing. M. 154
Water Plant, Municipal, in Monrovia, Wis. 380
Water-proofing, An Efficient. M..... 322
Water-proofing Concrete, Patents on. M. 160
Water Purification Plant, Grand Rapids, Mich., Municipal. By J. W. Armstrong, New York City..... 429
Water Purifying Plant, The Chara. By James Scott 301
Water Rates and Water Works Management, Books on. Q..... 291
Water Rates in Small Cities. Q..... 131
Water, Right of a City to Sell Beyond Boundaries 142
Water Supply System, Duplicate. Q.... 210
Water Supply for Pittsburg, Increased... 302
Water Supply of Los Angeles, Disposal of Surplus 302
Water Supplies by Compressed Air. Q.. 130
Water Supply Furnished by City, How to Measure. Q. 130
Water-tight Sewer Joint, A Flexible. M.. 233
Water Waste. E..... 125
Water Works Plant, Methods of Keeping Records of Improvements to Established. By Charles Carroll Brown.... 13
Water Works Problem in Oklahoma Settled 483
Water Works System of New London, O.. 380
Water Works, Electric Light and Ice Plant at Loveland, O. By Frank P. Perkins, Buffalo, N. Y..... 198
Water Works Questions, Court Decisions on. Q. 291
Water Works Case, The Laporte, Ind.... 219
Well Through Sand, Sinking. Q..... 42
Width of Street Pavements, The. I. The Influence of Substructures. By George S. Webster, Chief Engineer, Philadelphia, Pa. II. The Influence of Surface Conditions. By George W. Tillson, Consulting Engineer, Borough of Brooklyn, N. Y..... 31
Winnipeg, Can., Municipal Power Plant.. 461
Wooden Block Pavement, Expansion and Contraction in. W..... 294
Wooden Block Pavement, Proposed Method for Treating Block for. W..... 375
Wood Block Paving, Specifications for. Q. 374
Wooden Poles with Concrete Reinforcing 461

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If you are seeking employment, have second-hand machinery for sale, want to purchase machinery or supplies, want competent men to fill responsible positions, or have proposals to advertise, an ad. in these colums will put you in touch with responsible parties who can supply your wants.

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Municipal Engineering Co., - Indianapolis, Ind.

FOR SALE—Buff & Buff Engineer's Transit. Full vertical arc. Solid silver graduations. Gradiemeter attachment. Used one year. Rod, tape, etc. Write for prices and full description. H. L. Andrews, Harrold, S. D.

WANTED—Graduate in civil engineering, 1911, desires position with contracting or consulting firm. Single; 23. Will go anywhere. Open for engagement December 1, 1911. Can furnish references. Address S. E. L., care of Municipal Engineering, Indianapolis, Ind.

WANTED—A position as superintendent of water company, by a young man who is not afraid to work. Have had about ten years' experience in water works engineering, surveying, mapping and bookkeeping. Have also done considerable sewer work and other engineering work for borough. Best of references as to character, reputation and ability. Salary moderate. Address, Israel R. Burt, Port Allegheny, Pa.

NOTICE TO SEWER CONTRACTORS.

Sealed proposals, addressed to the Village Clerk and indorsed "Proposals for constructing Sewers and Sewage Purification Works," will be received by the Village of Pleasant Ridge, Hamilton County, Ohio, until twelve (12) o'clock noon of Saturday, the 16th day of December, A. D. 1911, and then and there for furnishing the necessary tools, labor and materials and constructing the proposed sanitary sewer system and sewage purification works according to the plans and specifications therefor on file in the office of the Village Clerk.

Each bid must be accompanied by a cash deposit or a certified check on some solvent bank, payable to the order of the Village Clerk, for an amount equal to five (5) per cent. of the aggregate amount of the proposal, as a guaranty that if this proposal is accepted a contract will be entered into and the required bond will be furnished for the satisfactory execution of the work.

Plans and specifications can be seen and forms of proposal can be obtained either at the office of the Village Clerk or the engineers, the Riggs & Sherman Company, 13 the Nasby Building, Toledo, Ohio.

The Council reserves the right to reject any or all bids.

By order of the Council.

H. B. HAYDEN, Village Clerk.

Pleasant Ridge, Ohio, November 16, 1911.

OFFICE OF CITY CONTROLLER, McKEESPORT, PA.

Sealed proposals will be received at the office of the city controller until 7:30 p. m., Monday, December 27, 1911, for the following:

An 8-inch terra cotta sewer in Franklin avenue, from Robinson street to Fayette street, and on Fayette street, from Franklin street to Fawcett street.

A 15-inch terra cotta sewer on Archer street, from Havilla street to Wayne street, and Wayne street, from Archer street to West Sixth avenue.

An 8-inch terra cotta sewer in Fawcett street, from Fifth avenue to Robinson street.

Bond in the sum of three thousand dollars must accompany each proposal.

Plans and specifications on file in the office of the city engineer.

The city reserves the right to reject any or all proposals.

C. E. SOLES,
City Controller.

NOTICE TO BRIDGE CONTRACTORS.

Sealed proposals will be received at the office of the auditor of Union county in Creston, Iowa, up to 1:30 p. m., Thursday, January 4th, 1912, for the furnishing of material and construction of all bridges which may be ordered by the Board of Supervisors of said county during the year 1912, bids to be in accordance with plans and specifications on file in the auditor's office. Also a separate bid for all structural material and for 3-inch Oregon fir flooring per M, and for Red Cedar and steel piling A. B. & C. per lineal foot. All material to be priced F. O. B. Union County, also in place.

Also proposals for the erection of cement culverts or bridges over 6-ft. in length, and cement or concrete abutments under bridges as ordered, on a cost plus percentage basis.

All proposals to be submitted on uniform blanks to be furnished by the county. The Board of Supervisors reserves the right to erect all bridges under 40 foot in length at their option and the right to erect cement or concrete abutments. The right to reject any or all bids or any part of any bid is reserved. Bids will be opened and considered at 1:30 p. m. on Thursday, January 4, 1912. A certified check for $200 must accompany each bid as an evidence that contract will be entered into, if awarded, the same to be forfeited to the county in case of failure to enter into suc hcontract, otherwise to be returned to the bidder.

By order of the Board of Supervisors, November 13, 1911.

E. G. Smeltzer, County Auditor.

Approximately 310,000 square yards of either asphalt, bitulithic or concrete pavement will be laid by Boise, Idaho, during 1912.

Address any inquiries to the CITY CLERK.

ENGINEERING PROPOSALS

The Bureau of Technical References

will issue gratis **Condensed Summary Record Index Cards,** with or without **Abstract Titles of Experience Records,** to any employer writing or wiring specifications for Expert Assistance.

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MUNICIPAL ENGINEERING

VOLUME XLI NUMBER ONE

JULY, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

MAKING OUTLINE OF WORK.

AS SOON as the plans and specifications for any new job are received in the office first go through the specifications, noting each and every requirement, using the standard form "Outline of Work" herewith submitted, designated as "Plates II and III."

The form submitted is a standard and is to be used for each and every job, and from practical experience it has been found to cover all working conditions, whether the job is large or small. This form can be used for bridges, buildings, sewers, earth work, railway construction, pavements, sidewalks, and, in fact, every kind of work coming to any contractor. The form is adaptable for all classes of work and the benefits to be obtained from the use thereof are briefly stated as follows:

First. In filling in the general heading, giving the nature of work, where located, owner and architect or engineer, together with the estimate number, we secure an index for permanent record. It is suggested that estimate numbers begin with No. 1 each year, thereby automatically recording the estimating labor for each season. Knowing the number of jobs secured and being careful to distribute the cost of labor in estimating all jobs, we may arrive at a percentage of cost that such estimate bears with relation to the total cost of our general office charges. Preferably, such general office charges are kept separate for calendar years, together with the total volume of business for the corresponding period.

When times are dull and competition "fierce," then estimating will constitute a larger percentage of these charges than when work is plentiful and most of the general office time is spent on actual supervision. This overhead charge, as a whole, naturally fluctuates, as it is considered as a percentage on the total volume of business when making an estimate. Rent, light, heat, etc., together with a certain amount of salaries (which must be maintained regardless of new work) are all independent of the volume of business, so that the percentage to be allowed must really be a matter of good judgment based on extended past experience. The contractor's line of work is not one where he can reasonably count on a steady increase or increment each year, but, instead, where notwithstanding his reputation, he must compete by bidding for each and every job secured. Therefore, a reasonable amount should be added to each estimate, for just such charges, and yet when times are dull no one job can be burdened with the whole charge. An average over several years is, therefore, of more value than to use the actual results for any one period. The cost of estimating should also be determined as a percentage of the total estimated cost of proposed work passing through the office, whether the jobs are or are not secured. Such a record gives data upon which to base a proposition when called upon for a proposal for examination of a promotion project. From an engineering and estimating standpoint, regardless of construction, costs should be kept of surveys, reports, etc., as many times propositions will arise which are to be used for promotion purposes and should be paid for by the parties benefited.

Second. In filling in the secondary heading with reference to date of letting, to whom the bid is to be addressed, amount of certified check, amount of bond, form to be used for bid, amount and manner of payments during progress, beginning and completion of the work and penalty and bonus stipulations we have all the essentials necessary for the submission of a formal proposition, with also due consideration for the financing of the work. The latter point is of great importance, as many times the payments, penalty and bonus must be considered as a part of the cost of the work. For instance, in some cases weekly estimates

CONTRACTING PRACTICE

A. B. C. CONST'R. CO.

OUT-LINE OF WORK

NATURE OF WORK Reinforced Concrete Bridge — EST. No. 40
WHERE LOCATED Rocky Creek on Broadway — SHEET, No. 1
OWNER City — ARCH OR ENGR. City Engineer — DATE 5/26/11

DATE OF LETTING 6/16/11 — ADDRESS TO City Clerk
AMT. CERTIFIED CHECK $5000.00 — AMT. BOND 25% of Bid
FORM FOR BID Printed forms fr. City Clerk — PROGRESS PAYMENTS 85%
BEGIN At once — COMPLETE By Dec. 31/11 — PENALTY 50 per da. — BONUS None

ABSTRACT OF SPECIFICATIONS & PLANS

ITEM OF WORK	REFER TO PAGE SPEC.	REFER TO SHEET PLANS	NOTATIONS WITH REGARD TO GENERAL REQUIRMENTS	NOTATIONS OF SPECIAL AND UNUSUAL FEATURES	SEE PAG. PAT.
1 Excavation	7	3	Larger than concrete sizes to provide for concrete forms and pumping.	Depth may be increased at same unit price.	1
2 Piles	7	3	Any sound timber - peeled - 8" to 12" in. size	Water jet may be required	1
3 Centering	8	1	Not less than 2" lagging - dressed	Removed when permitted	2
4 Concrete	8,9,10	1	Grade A 1:2:4 - ¾" stone - Arches only	A sack of cement to a cu. ft.	2
			" B 1:3:5 - 2" stone n gravel - Spandrel and retaining walls	to be taken as one cu. ft. machine mixing -	
			" C 1:3:5 - 2½" stone n gravel - piers abutments and foundations.	Quaking mixture Rammed - Lean	
			" D 1:1½:2 - ½" gravel - sidewalks	Bottom - provide forms	
5 Reinforcing Steel	10	1	Mechanical Bond - Elastic Limit 50000# Ultimate strength 80000# Proformes for built up frames	Payment only for actual ∫ used.	3
		1			
6 Drainage	11	2	Each pier - 2 W 1" Pipes - Conn with stone and stone		4
7 Waterproofing	11	4	Top arches, piers, & Abuts - Plasto - 1:3 - 2" thick Abutments & Retaining Walls - 1:3 - ½" thick	Proper Amt of Melrose or equal.	4
8 Filling	11	4	Between spandrels to sub grade - earth n gravel	Completed	4
9 Conduits	11	4	Conduit bops under sidewalks		4
					5
10 Sidewalks	11,12	4		See spec. of City	5
11 Pavement	12	4	Creosoted Blocks	" " " "	5
12 Approaches	12	5	Separate from bridge proper	Same spec. as to material	6
13 Old Bridge	12	2	Owner to Work House - Shall Hauled away		1
			This removed to 3' below low water	No salvage provided	
14 Name plates	12	5	One Bronze plate		6
15 Drainage	13	2	Four Conduits - 4-6" Vit pipe		6
16 Stone	13,14	6	Belfast #1 Colothic - Facing throughout and all ornamental work except where granite is specified - general thickness facing 8" with 12" bond stones every 6 sq ft.	Samples at Engr. office ½" Pointing of Mayers Pozzolan Cement also used for joints ⅛ x ¾ 1 cem to 1 sand	7
			Moulded work sand rubbed finish - Pulmish		
			anchors and dowels dipped in hot coal tar	Balustrades denoted	
			Carving & pylons and steps -	Submit plaster model	
			All stone set in Mayers Pozzolan Cement Mortar 1:2		
			Granite, 2 abut and piers from 2' below low water to height on drawings	Light color from quarry to be selected	
			Approaches to have 14" thick granite curb		
17 Wiring	16	7	Wire for electric lights to 12 Standards in Conduits - Bronze Cabinets - Contract separate each Standard	28 sub-bd 48-16 C.P. and 12-32 C.P. lights.	7
18 Piping	17	7	Place gas piping in Conduits to Standards		8
19 Covers	17	7	For Conduits & C. Mason Bros treads		8
20 Standards	17	7	12 large and 4 small bronze as shown n drawings	Must specify thickness of bronze	8
Remarks	A		Bids itemized as per pages 2 and 3 of spec. These pages give Engrs quantities	See Note	
	B		Union Labor specified	See Note	
	C		Appropriation $75000 with a possible available extra of $15000		

PREPARED BY D. F. M. 5/26/11 — CHECKED BY H.B. 5/27/11.

PLATE II. CONTRACTING PRACTICE.
Summary of Work Required for Reinforced Concrete Bridge.

are allowed the contractor, and a job of this kind will finance itself. Incidentally it might be remarked that under such terms, or at least not exceeding monthly estimates, the owner secures his work at the minimum of cost. In other work, especially in that for some municipalities, no payments are made until the work is completed and accepted. In a case of this kind arrangements must be made to secure funds to carry the entire cost, and there must be included in the estimate the interest on such funds. As the loaning of money on contract work under these conditions is more speculative than investment, it may be expected that money cannot be secured for less than the usual rate of interest plus a bonus, and in the aggregate these two items will amount to at least 10 to 12 per cent. Under these conditions either the owner or the public pays the bill, provided the bid is properly made.

Sometimes, when the time of completion is the principal element in awarding of the contract, it is wise to include in the cost an allowance for anticipated penalty and set the time of completion at a very early date. On the other hand, if a bonus is offered it is probably advisable to set an early date for completion and make a corresponding increase in the unit cost of the work, looking to the bonus to repay for such extra cost and decreased output caused by overtime and night work.

Third. The third heading covers the abstract of specifications and plans and serves the purpose of itemizing the principal work with a reference to the page of the specifications and the sheet of plans showing such work. The larger space is given to notations with regard to general requirements and a secondary space is allowed for notations of special and unusual features. This idea automatically presents to the eye at a glance an absolute certainty as to whether the specifications and plans are normal or abnormal. The less items that appear in the special column the more certainty in estimating.

By allowing a final column for reference to page of estimate we not only have the reference, but also the opportunity of checking off each item so as to be sure nothing is forgotten. A notation should be made as to who prepares such an outline or abstract of work, and in any case of important work it should be checked. The benefit of such an outline of work is not confined to the suggestions in the foregoing, but also exists in the more systematic, intimate acquaintance with the subject matter gained by the one making the abstract and checking same.

In any case in making a proposal we read the specifications and look over the plans. If at the time of doing this a blank form is used as suggested, we not only guard against omissions, but we gain a more retentive recollection of the requirements, due to the very fact of concentrating our mind to the end of producing the concise condensed abstract. We are also prompted to differentiate between the normal and abnormal requirements. It takes but a few minutes longer to go through a set of plans and specifications this way and the result is far more satisfactory, besides the fact that such abstracts, whether the job is secured or not, are of permanent value as part of the estimate files.

Such an actual summary of work taken from the individual specifications is preferable to any standard printed form, even in the case of the specialist who attempts to list everything on a standard estimate sheet. Human nature will prompt a close adherence to such a form and a slighting of specials pertaining to the job under consideration. Again, since the printed form is arranged in a certain order and very little opportunity given for interpolations and additions, the tendency is to condense items or run specials under miscellaneous or incidentals, which is misleading and makes the estimate obscure.

As an illustration Plate II shows a standard form of this kind covering the work of a reinforced concrete bridge. The original size of the blank used for this work is 8½x14 and the abstract covers one page only. The original specifications for this work covered over 18 pages of the same size, and yet on this abstract are contained all the essentials for estimating, together with references to the proper page of the specifications and plans for any required details. This is one of the cases where the specifications themselves were not indexed or paged, a condition which is more often the case than would be expected. The outline of work supplies the deficiencies of the specifications, at the same time presenting the matter to the contractor in the best possible condensed form for pricing. Especial attention is called to the many notations in the "special and unusual features" column. Most of these items cannot but help have an effect upon the cost because of the lack of certainty as to the meaning of the specifications and as to what may be required by the engineer.

Compare this plate with Plate III, which is the same standard blank, covering a reinforced concrete building. Note how few items appear in the special column. This at once is an indication that the specifications for the building are definite and there is no occasion for a misunderstanding. Both plates II and III

Contracting Practice

A-B-C CONSTR. CO.

OUTLINE OF WORK

NATURE OF WORK 5 Story R. Concrete Bldg. 51X100 EST. No. 41°

WHERE LOCATED Metropolis SHEET No. 1

OWNER Mercantile Company ARCH OR ENGR John Doe DATE 6/1/11.

DATE OF LETTING June 7th ADDRESS TO Architect.

AMT. CERTIFIED CHECK none AMT BOND 75%

FORM FOR BID Architects form PROGRESS PAYMENTS weekly.

BEGIN At once COMPLETE State time PENALTY Not Stated BONUS None

ABSTRACT OF SPECIFICATIONS AND PLANS.

ITEM OF WORK	REFER TO PAGE SPEC	REFER TO SHEET PLANS	NOTATIONS WITH REGARD TO GENERAL REQUIREMENTS.	NOTATIONS OF SPECIAL AND UNUSUAL FEATURES	SEE PAGE OF EST
Excavation	6	1 & 2	Investigate conditions		1
Ret. Walls	7	2	Concrete - See plans		1
Underpinning	8	2	Meridian St side - question as to depth.		1
Base floor	8	3	4" x 3/4" at 1.1½		2
Rein Concrete	9	3	1:2:4 stone or gravel		2
Centering	16	3	Removal 2 to 7 days - 1" or 2" lumber		2
Loads	17	4	1st - 300# - Others 150# - Roof 40#		2
Cem finish	21	3	1:2 - 1" thick	Bonding Coat" Insolite	3
Tile Floors	21	4	Vestibule and lobby	50¢ per 4'	3
and Marble			Pavonazza Marble - Tosco Products Co		4
			Milwaukee Wis		4
Maste Flooring	22	4	First floor store room and offices	Colors as selected	4
Brick	22	5	Walls & piers - Standard hard burned,		5
			salid or hollow		5
Face	22	5	Western Brick Co's #730 - Colored mortar	#14.00 M.	6
			All brick in cement mortar 1 part cement		6
			and 3 parts lime mortar		7
Stone	23	5	Blue Bedford base blocks Mer St. & Jackson		7
			Place also window sills		7
Partitions	24	6	Tile around elevators & wall first floor		7
			" must end at building		7
			All other and Pent House, metal studs &		8
			lath		8
Terre Cotta	26	5	Front elevation		8
Plastering	27	6	All metal Partitions, all ceilings, and	Color to be selected	8
			tile partitions, first floor	2 coats + white coat	9
Carpentry	28-30	6	See plans for Dohlstrom Metal Doors	Mill sub Bid	9
			Should include hand rail on stairs	Sub Bid	9
Roofing	31	7	5 ply pitch		10
Steel work	32	8	Angle Iron Lintels, bolted to Concrete		10
			Angle Iron curb corner		11
Ornamental steel	33	8	Brass Thresholds - Pittsburg Am. Light Metal Sub Co	Sub Bid	11
			Gas pipe railings, stairways complete		11
			Well hole railings - treads & landings		11
			Wrought Iron doors, Pass Elevator - Wire Under		11
			Guards - Fire Escape		12
Painting	36,37	9	See specifications	Sub Bid	12
Glass & Glazing		9	" "	" "	13
Side Walk Lights	38	9	Luxifer prisms		12
Sheet Metal	39,40	9	See spec. - Skylights - Vents - Flashing	Tile Curb (12")	12
Hardware	40	9	Rough hardware by Contr. - Finish hdw by Owner		2

PREPARED BY D. P. M. 6/1/11 CHECKED BY J.H.B. 6/2/11

PLATE III. CONTRACTING PRACTICE.
Summary of Work Required for Reinforced Concrete Building.

are *bona fide* abstracts of actual specifications and are used in the illustrations, although fictitious names and addresses are given, for the reason that only by using such actual cases can we illustrate the adaptability of our system to meet the various ideas and manner of preparation of plans and specifications of the many individuals with whom we must deal as architects and engineers. The above is no criticism of the architect or engineer. The minds of all men do not work the same. Some prepare strong specifications, with an absolute lack of system in indexing, arrangement and definiteness; others are extremely systematic, but produce specifications which are unintelligible or inconsistent.

The next in order is to carefully inspect the plans, comparing with the abstract of specifications. Make such explanatory notes on abstract as are revealed by plans and add to abstract any work on plans not specifically mentioned in specifications.

Compare specifications and plans and note discrepancies and differences with a view of securing an explanation from the architect or engineer, and in lack of same, of so making bid as to keep on the safe side.

Logically the next step before taking off any quantities is to carefully and without haste decide how the job under consideration can be handled and decide just what equipment, how placed and what organization is necessary to execute the work at the least cost.

This first decision is all important. Many times a "guess bid" is made without any particular thought as to how the job is to be handled if the bid is successful. In other words, this all-important decision is deferred until time demonstrates whether there is any use in spending time and thought on such a possibility. Such a method is foolishness. The only way to make an intelligent bid is after proper consideration of organization, equipment and the method of operation, the proposal being made with a confidence that the figures submitted are reasonable and accurate, and with the expectation of being awarded the contract.

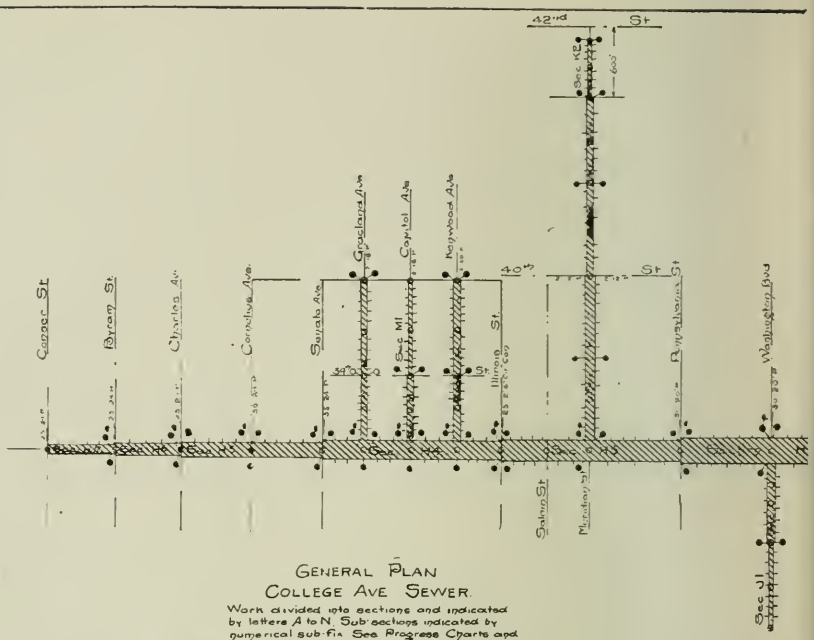
No proposal submitted can result in any satisfaction to either the recipient or the contractor which does not include such a careful examination of the plans and specifications and an inspection of the site of the work. If such a study be given the proposition there will result a plan of operation and a feeling of certainty and promptness in the beginning of the work which will go a long way towards satisfying both parties.

Changes in this plan of preliminary operation may be required, and new ideas and methods promulgated during the actual progress of the contract, but this in no way affects the definite plan which must be the basis of the estimate in the beginning of the work. Any successful proposal requires a definite plan of action and the decision regarding same is better expended at the time of making the estimate than to await the awarding of the contract. Any estimate lacking such a plan of operation will not bear investigation or examination.

Granting, then, that the plan of attack has been decided upon, the decision should be made a matter of record, both by written description and by the preparation of sketch plans showing the general layout of the plant and method of operation. These plans serve as a basis of the amount to be included in the estimate for equipment and the labor of installation, and also as a reminder and guide in the actual moving in on the work, in case the job is secured.

It is true that many times changes for the better are made in such a preliminary plan, but in the majority of cases such changes and improvements are prompted by the study of the proposition at the time the estimate was made. There can be no improvement or better second thought unless at some time previous suggestions have been made. Prepare this preliminary plan in such a form that it may be preserved. If possible, make this plan on the same scale as the general plans of the work. In a great many cases this can be accomplished by making a tracing or sketch with the addition of such notations and additions as are necessary to explain the estimate. However, if the work covers a great many sheets and is thereby complicated, it is best to prepare a new plan on a reduced scale, indicating all the work to be done. A condensed profile will assist the preparation of an estimate far in excess of the value of the time to prepare the same.

It is astonishing in how many cases a really complete set of plans from an engineering and architectural viewpoint, is lacking in this condensed information required for inspection and an intelligent estimate by the construction man. Only this day the author condensed on a sheet of double legal size (17x14 inches) all the essentials in plan, profile and section of a sewer job composing ten sheets 24x36 inches. The sheet thus prepared did not displace these working drawings, but it did furnish a "birdseye view" of the entire job with which the contractor could go into the field, view the site and be properly prepared to make an intelligent estimate from the working drawings. This sheet did not, therefore, displace the working drawings, but did serve a very important connection therewith. This condensed sheet, giving all information,

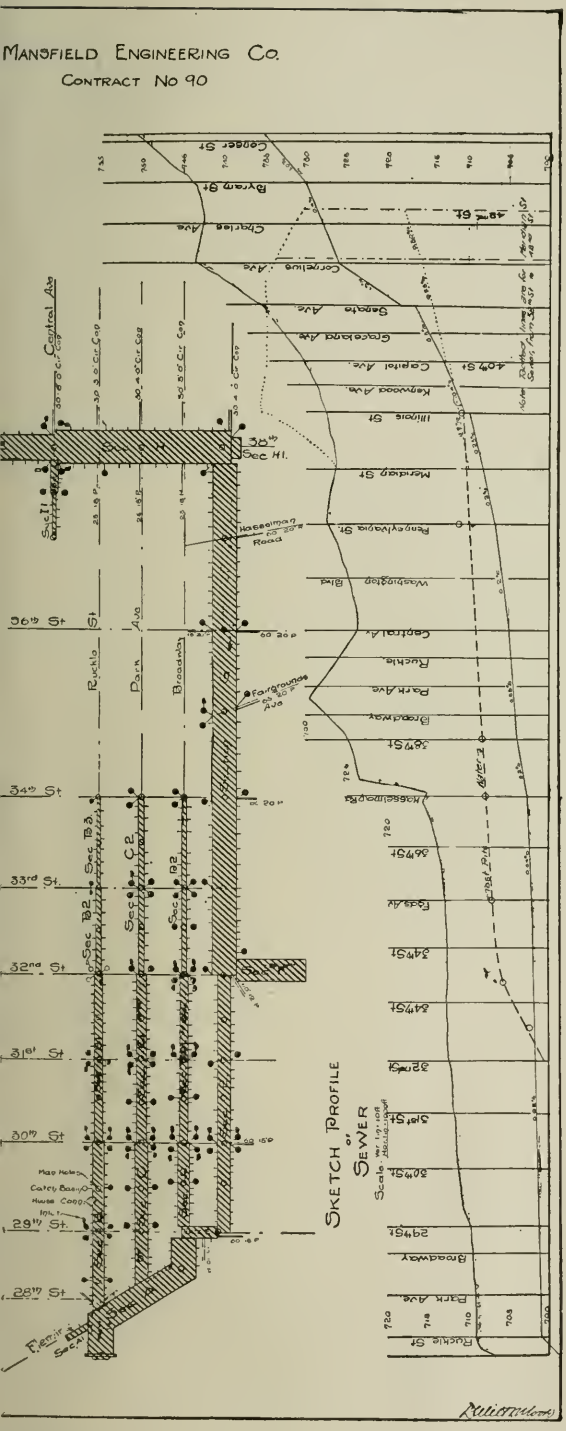


General Plan
College Ave Sewer.

Work divided into sections and indicated by letters A to N. Sub-sections indicated by numerical sub-fix. See Progress Charts and system of daily reports, also table below

Section	Location			Type		Length	Excavation					Concrete		Type of Mach		Progress						
								Cubic Yards				Yards per Foot	Total			Rate						
	In.	Between		Con	P		Av Cut	Estimate	Actual	Surp				Excav	Concrete	Beg	Com	Av Pt Day	Foreman	Perc't	Remarks
A	Flem.		29th	6'-0"		1265	8	3186		2024		.519	657								
A1	Flem		R'kle		24	350	12	454		67											
B	Ruckle	Flem.	30th	3'-0"		1310	9	2402		747		.285	375								
B1		30th	32nd	2'-6"		1345	9	2194		592		.248	334								
B2		32nd	33rd		20	665	16	1380		126											
B3		33rd	34th		18	645	16	1147		105											
C	Park	Flem.	30th	3'-0"		1150	10	2343		656		.285	328								
C1		30th	32nd	2'-6"		1340	9	2233		590		.248	332								
C2		32nd	34th		20	1320	8	1332		251											
D	Brd'y	29th	30th	3'-0"		670	9	1228		382		.285	191								
D1		30th	32nd	2'-6"		1350	10	2300		594		.248	336								
D2		32nd	34th		20	1315	8	1332		250											
E	College	Bd'y	32nd	3'-0"		2325		4736				.285	663								
F	32nd	Coll.		3'-0"		400	12	1278				.441	176								
G	College	32nd	38th	6'-0"		3940	13	16128		6304		.519	2043								
H	38th	Coll.	Cent	8'-0"		1325	24	12936		3675		1.048	1389								
H1		Coll.		5'-0"		65	23	416				.441	29								
H2		Cent	Penn	6'-0"		1325	21	8745		2120		.519	688								
H3		Penn	Ill'is	5'-0"		1325	19	6998		1590		.441	584								
H4		Ill'is	Sen.	4'-0"		1335	17	5464		1355		.365	484								
H5		Sen	Chas	3'-3"		1005	18	5852		605		.304	306								
H6		Chas.	Byram	3'-0"		510	14	1452		291		.288	145								
H7		Byram	Cons'r		24	500	15	973		95											
I	Centr'l	38th			15	345	14	540													
I1					12	345	14	447													
J	Wsh. Bv.	38th			18	690	16	1432		100											
J1					12	700	12	404													
K	Merid	38th	40th		20	1330	23	3965		150											
K1		40th			18	1270	22	3105		100											
K2			42nd		15	600	13	866													
L	K'nwood	38th	40th		20	1285	12	2000		125											
M	Capitol	38th	39th		20	370	14	1000													
M1		39th	40th		18	715	14	1113													
N	Gc'land	38th	40th		18	1285	14	2053		100											

PLATE IV. CONTRACTING
Outline of Work for



PRACTICE.
Sewer Contract.

was prompted by the writer's being called as an expert in construction in litigation over a certain sewer which it was contended was deficient in many respects. During the trial it developed that all the available references were to this multiplicity of sheets, overlapping and drawn square with the sheets, but not with the world. No ordinary man could be expected in reasonable time to ascertain what particular part a witness was referring to in his testimony. The simple sketch map referred to served the purpose of adjusting in the minds of all interested the direction of the sewer, the relation to streets occupied and cross streets and designated without any possible misunderstanding the location of all troubles brought out in the testimony.

The labor spent on a preparation of such a plan is not lost, inasmuch as it forms the beginning of just such a preliminary operation and layout plan mentioned above, and this is not all, for if such a plan is properly prepared it will take its place in the system of progress reports in case the job is secured. For the purpose of estimating the plan may be prepared roughly as a sketch, but in case the proposal is accepted tracings can be made and blue prints secured which will serve to illustrate in the best possible manner the field report.

Plate IV shows a sewer job for which a "Scheme of Operation" was prepared, meaning thereby a condensed plan and profile of the work contemplated. This first rough sketch was used in inspecting the site, in the making of notes and in planning the organization and mode of operation. In this preliminary stage the sketch was not nearly so complete, as shown in the plate, but did answer the needs of the moment. When the job was secured the sketch was completed and traced in a neat and complete shape, as shown, to form the basis of all working thereafter. Additions were made to harmonize with the progress charts, as will be explained in succeeding articles.

It will be noted that the sewer work, "Plate IV," is cut up into 34 sections for the purpose of progress charts, reports and cost analysis. By a reference to the table in the left-hand corner the need of such a method is suggested not only for this actual job, but for all work.

As an illustration: Section A is a six-foot circular concrete sewer in an average cut of eight feet. Section H is an eight-foot circular concrete sewer in a cut of twenty-four feet. Both of these sections are a part of the same sewer system, but certainly it is not to be expected that either the cost of excavation or concrete will be the same or even approximately so. Any average over the whole job, including these sections and the others of

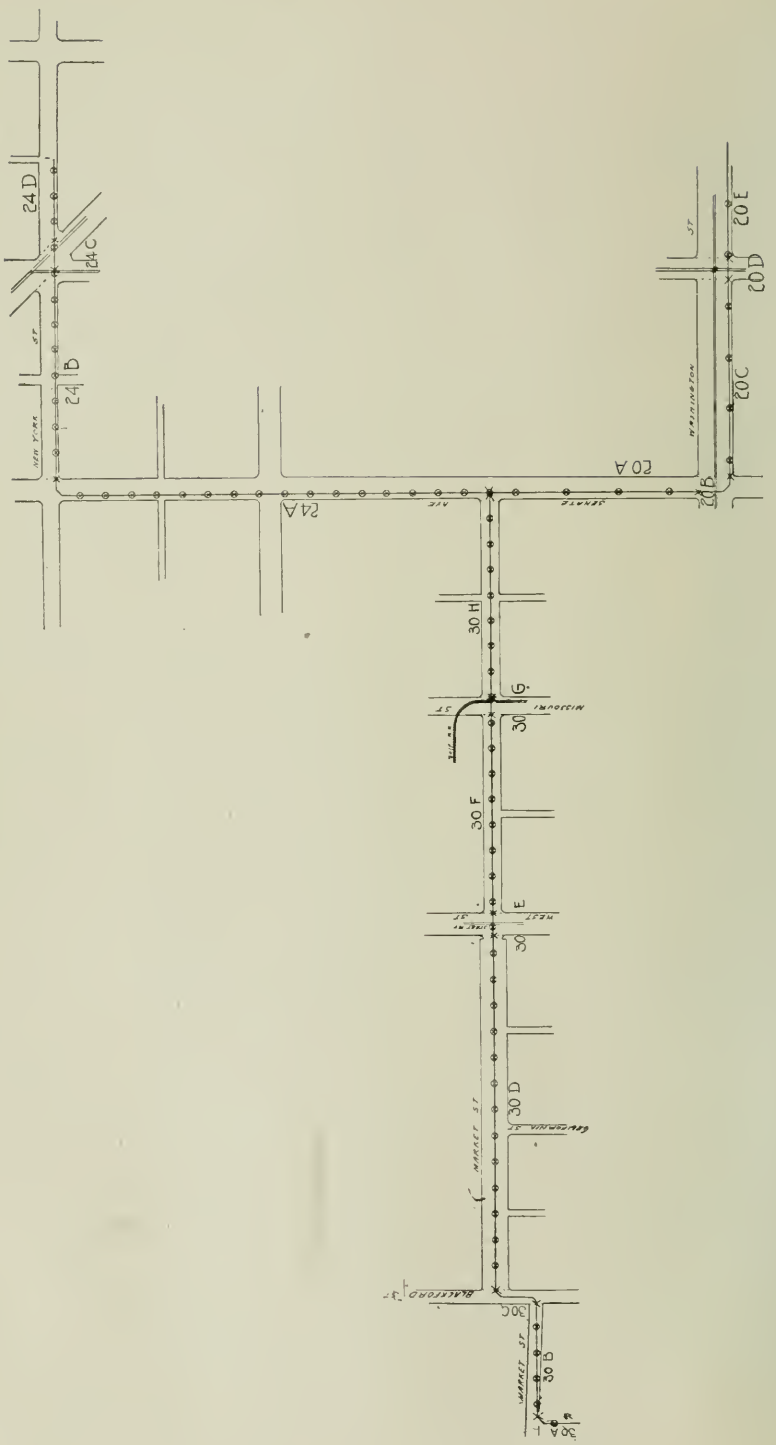


PLATE V. CONTRACTING PRACTICE.
Layout of Sections on Reinforced Concrete Conduit.

intermediate sizes and depths, including pipe sewers, would be misleading for future reference and estimates. Within the limits of this job are contained a great number of sizes of sewer, both concrete and pipe, to be constructed at various depths—sometimes the same size and construction at different depths. As an illustration: Sction A calls for an average cut of eight feet, requiring only occasional shoring of banks and no solid sheeting. Section H2 calls for a twenty-one-foot cut, requiring solid sheeting in two sections of approximately twelve feet each. While the size of sewer is the same, it is not to be expected that the cost of excavation can be the same. Neither will the cost of the concrete be the same, as the rate of progress directly affects this cost.

Again, take Section H, an eight-foot concrete sewer, with twelve-inch walls, requiring a trench of a bottom width of ten feet. Compare this with Section K of practically the same depth but only a twenty-inch pipe, requiring a bottom width of trench of, say, three feet. The first section involves a large yardage per lineal foot and the latter a small yardage, yet practically the same amount of sheeting lumber and labor for placing and drawing same is required. Can the yardage labor cost be the same? No average cost of labor is applicable to any one section, therefore to gain an intelligent record for future use where the sizes and depths may occur in different propositions, it is necessary to divide the work into sections and so keep the costs. Other things than mentioned make the division by sections the most important of all stipulations as to estimate, construction and analysis.

The same character of work without any large variation of quantities may be constructed under absolutely different conditions within the limits of the same work.

Plate V shows a sketch condition of this kind. This work consisted of a reinforced concrete conduit in the downtown streets of a large city. It will be noted that the job is divided into sixteen sections, although there are only three sizes of conduits and the depth of excavation is really uniform. In this case the prefix numerals in each section indicate the size of pipe in such conduit. Section 24-B cannot be compared with Section 24-C, because the latter work is complicated by a street crossing, involving a diverging double track trunk line street railway, requiring tunneling under four tracks and special track work.

The same conditions apply to all work, bridges, buildings and what not, and later a considerable and more analytical study will be given this idea, which, as before mentioned, is the key to all successful analysis, being even more important than any system of cost recording, cost keeping or any form of blanks used.

Averages are all right when properly prepared, but "guess" averages are dangerous and especially so when they are based on so-called cost records, which cover a whole job, without a recognition of this point of sectional division.

Lump sum unit costs are more valuable when proper consideration is given to sectional division than are the most exact itemized unit costs when no attempt is made to segregate. The next article will take up the question of "Itemized Quantity Estimate," with notes on short cuts in estimating.

Steel and Cast Iron Pipe.*

By Allen Hazen, Consulting Engineer, New York City.

THAT which follows relates only to large mains, which I shall define provisionally as mains 36 inches in diameter and larger. In the early developments of the water works business there was but little use for such pipes. So far as they were used, cast iron was the material employed.

Penstocks for water power were among the most frequent examples of large pipe lines at an early date, and for these riveted wrought iron, protected by paint, red lead or other coatings early came into use; the same material was used in water works service occasionally, sometimes because it could be obtained cheaply, at other times because a reliable material was wanted for difficult service.

About twenty years ago steel plates became available in large sizes and at comparatively low prices, and these at once largely replaced wrought iron for such pipes. Pipes made from steel plates had advantages and soon found extended application in the construction of the large water mains that were then demanded in

*A paper before the American Water Works Association.

increasing numbers to meet the needs of growing populations and the increased per capita use of water.

From that time to the present the relative merits of cast iron and steel for large water pipes have been discussed. Much has been said upon both sides. The author will not attempt to enumerate all the arguments that have been used, but only to present the salient features of the case as they present themselves to him, under the conditions that now exist in the northeastern states.

Steel costs more per pound than cast iron, but it is stronger and in some respects more reliable. A steel pipe a quarter of an inch thick may be, and often is, stronger than a cast iron pipe an inch thick, and is commonly cheaper. When steel has replaced cast iron in pipe it has simply done what steel has done in a hundred other directions, in buildings, in machinery, and wherever a higher form of metal has advantages more than commensurate with its increased cost.

In the past a comparison of the two materials for large pipe lines has often rested upon a consideration of the relative durabilities, real or supposed, taken in connection with the relative costs. The steel pipe has been assumed to be less durable, because the metal was thinner and would rust through quicker. But it was much cheaper. For instance, at Springfield, for twelve miles of 42-inch pipe for which competitive bids for steel and cast iron pipe were obtained in 1908, the relative costs were in the ratio of 2 for steel to 3 for cast iron. Cast iron would have cost $600,000. It was actually laid in steel at a cost of $400,000. This ratio probably is not far out for the approximate relative costs of the two materials for large pipes under considerable pressures under the conditions that have ruled in the last few years.

The matter has frequently been presented in this way: The money saved by using steel pipe in a certain case, amounting, let us say, to one-third of what would be the cost of a cast iron pipe line, or 50 per cent. of the cost of the steel pipe line, if put at interest at prevailing rates, would amount to enough to lay a new line of steel pipe at the expiration of some arbitrary period for which it is assumed that the steel pipe will last. The period assumed in making this calculation has seldom been less than twenty-five years or more than forty years. In many cases this calculation has been made and the steel pipe has been put in with the belief that it was better business to use it, even though it rusted through and ceased to be serviceable at the end of the relatively short period assumed for its life.

Large pipes, as defined in this paper, are most frequently used in the supply pipes of a water works system, and less frequently in the distribution, and in such supply mains other conditions than the wearing out or loss of strength of the metal commonly limit the useful life of the pipe.

With both cast iron and steel pipes there is a continuous decrease in carrying capacity occasioned by the roughening of the interior surface, principally due to tuberculation. This roughening is not associated with any appreciable reduction in strength, but it does practically reduce the amount of water that can be carried. On the other hand, the amount of water that has to be carried normally increases steadily with increasing population. Reduction in pipe capacity and increase in demand limit the time that a given pipe will by itself perform the functions for which it was laid, and when, because of these, it ceases to be able to perform its work, another line must be laid to help it out. When this occurs the first line may be considered to have lost a part of its value, and it may then be worth only the difference between what it would cost to lay a new main to supply the whole service and to lay a new main to supply the service in connection with it. This will commonly be only a fraction of first cost. Much of the value is then gone, although the pipe may be physically sound.

These practical considerations in most cases limit the full useful life of steel and cast iron pipe in supply mains of growing cities to periods below the term during which the shell is sound.

The oldest steel pipe lines now in use are about twenty years old. They are still in good condition. Little has been spent upon them for repairs, and there is every prospect that they will continue in useful service for a long time. Curiously it is some of the more recently laid lines that have given most trouble from deterioration.

The weakness of a well-made steel pipe is its liability to perforation. The experience of the last years has emphasized this, and recognition of a weakness is the first step in correcting it.

Perforations of steel pipe are caused in two ways:

1. Mechanically. The escape of a small quantity of water through an accidental opening (at a high velocity because the pressure in the pipe is great) results in eddy action on the outside of the pipe, which gathers grains of sand and brings them forcibly against the outside of the pipe, and in a comparatively short time cuts the steel and makes a perforation of sufficient size to be an important leak. The process of perforating a steel pipe in this manner is a rapid one

after it starts. If the pipe is left with considerable leaks, then enlargements may be expected to occur in short order.

The remedy is to test the pipe under more than full pressure before the trench is back-filled, to caulk it tight and to make the joints so substantial that there will not be chance for openings to occur. This may be done by careful workmanship and good inspection; it has been done with most of the lines of steel pipe that have been laid. Failure to do it in some cases has brought its own lesson promptly. Looking at the matter broadly, there is comparatively little trouble in preventing such mechanical perforations, and little trouble is to be expected from them as the years go by.

2. Chemically. It is a curious property of steel plates that corrosion is not equally distributed, but is concentrated in small places. Once in a while there is a place which, for some reason, corrodes more rapidly than the rest of the plate, and where finally the steel will be eaten entirely through, making an opening which allows the escape of water. There is clearly some imperfection in the steel plate which allows the corrosion to take place, which finally results in perforation, while 99 per cent. of the surface of the plate remains entirely free from deep corrosion.

The matter is not an easy one to investigate, because when the perforation becomes apparent, whatever there may have been in the original plate to start the corrosion has been entirely eaten out and it therefore cannot be found.

Pittings and perforations have developed most extensively in some lines of steel pipe that were not among the first to be laid. In one case salt water from the ocean was a contributing cause.

Different pieces of iron and steel behave differently in sea water, but in general they corrode rapidly, and we may well hesitate to use steel pipe where it will be exposed to the action of sea water, or other highly mineralized water. If it must be so used, the greatest care may well be taken to protect the pipe from contact with the water.

The writer believes that in many cases there is a reason for preferring steel to cast iron which is more important than the saving in cost, namely, the greater strength and reliability of steel. This greater reliability is due largely to the fact that steel is malleable, and therefore capable of being bent and deformed by settlement in the trench and movements under external forces without breaking or reduction in strength, whereas corresponding forces acting upon cast iron pipe would break it.

Cast iron pipe, in the past, has been commonly designed with a thickness of wall sufficient to resist, at an assumed tensile strength and with an assumed factor of safety, the internal pressure of the water in the pipe, with a further allowance for water ram, and generally with a further arbitrary addition to the thickness of the walls to cover inequalities in casting.

The actual test and proof of the formulas that have been used in making this calculation is that the pipe designed by them has in general been satisfactory in service, and the percentage of breakage in actual use has been small.

It is to be noted, however, that most of the experience relied upon in reaching this conclusion relates to pipes smaller than 36 inches in diameter. That relating to large cast iron pipes, although considerable, is by no means as great.

It now seems that the forces taken into account in the formula are not the only ones that tend to break and that do break cast iron pipe. In addition there are internal stresses due to the unequal cooling of the casting; there are stresses that grow out of the fact that the pipe is unequally supported along its length and acts as a beam between points of support, and especially there is the weight of the backfill in the trench carried on the top of the pipe and transmitted through the sides of the pipe to the material underneath. The tendency of this load is to break the pipe.

Prof. Talbot, of the University of Illinois, has investigated the amount of stress produced by fill on pipes of cast iron and other materials by embedding them in sand and loading them to the point of destruction, and has recorded amounts of load or fill required to break them under various conditions.

The important matter for us is, that the stresses that result from these other forces are cumulative to a considerable extent with those resulting from the internal pressure of the water in the pipe.

In a paper recently presented to the New England Water Works Association I attempted to analyze some of these stresses. I will not repeat at this time what is there printed; it will suffice to say that the stresses resulting from the load of backfill are important in pipes of large sizes and make a difference in the thickness of walls required. In other words, large cast iron pipe designed by the formulas that have been used are not as strong in proportion as small pipe designed by the same formula.

Practical experience seems to bear this out, for there have been relatively more breaks in large cast iron water pipes than in small ones. Statistics are not easily obtained of sufficient completeness to be of value, but I think almost any water works superintendent, who has had 48-

inch or 60-inch cast iron pipe in his system, or even 42-inch pipe, will support the proposition that the destructive breakage of such pipe has been greater proportionately than with small pipe.

Further, the possibilities of damage with breaks in the large pipes are greater. It is possible in a few minutes to do thousands of dollars worth of damage by one break in a large pipe in a populous district.

The advantage of steel lies largely in the fact that the walls are malleable; the pipe may be deformed by the weight of the material placed upon it, by inequalities in the trench, and by other forces, and the pipe still retain its strength. Although steel pipes have been designed with nominal factors of safety no greater than those used for cast iron pipe, when all the conditions are taken into account the actual factors of safety have been greater. With hundreds of miles of steel pipe in service in the last twenty years, nearly all of it in large sizes, there have been but few recorded breaks, and so far as the author knows, not a single case of a break of a destructive character; no such record can be shown for cast iron pipe.

With cast iron pipe, in case of a breakage the side of a pipe blows out, and all the water that the pipe is capable of carrying is discharged until the reservoir is exhausted or the supply shut off. On the other hand, the few breaks that have occurred with steel pipe have resulted in comparatively small openings which allowed the escape of some water, but not by any means the full discharging capacity of the pipe. In two cases the pipe has broken squarely off, leaving a circular opening all the way around, through which water passed. The ends of the pipe, however, remained intact and nearly in position, and the openings were of limited size and the pipes continued in service until arrangements could be made for repairing them by sleeves.

In another case there was one defective joint that broke under the test pressure that was applied before the pipe was put in service, tearing out and leaving an opening of some size, but this was repaired before the pipe was put in service.

The perforations of steel pipe that have sometimes occurred and that have been much talked about in the last years, resulting from the rusting or other corrosion of the metal and going entirely through the plate in some cases, result in a relatively small leak which does not interfere with the continued operation of the pipe, and which leak can be easily, completely and permanently repaired without shutting the water off.

It is to be noted that such breaks as have occurred in steel pipes most frequently during laying or preliminary testing, and less frequently in lines in actual service, have occurred, as far as the author knows, always where plates or lock bars or some other part was of steel that was relatively hard. The mild steel is the most malleable, and although it has the lowest tensile strength it makes the most reliable pipe. If there is breakage or trouble, look out for hard steel that has escaped the inspector, or that was near the upper limit of tensile strength allowed under the specifications. For the greatest safety use soft steel.

Steel pipe is made, at the present time, in two principal patterns, namely, with double riveted joints and with lock bar joints. The lock bar pipe is believed to be fully equivalent in smoothness to cast iron pipe, and will carry the same amount of water as cast iron pipe of the same size. Double riveted pipe, on the other hand, on account of the projecting rivet heads and the other irregularities of joints, has a greater frictional resistance. To obtain the same carrying capacity double riveted pipe should be 4 per cent. greater in diameter than either the lock bar or cast iron pipe.

The circular joints of both double riveted and lock bar pipe are commonly made in this country by riveting. This makes what is known as continued riveted pipe. With change in temperature the pipe tends to expand or contract, but is held by the earth and prevented from doing so, and the tendency is converted into stresses which tend to stretch or compress the steel, but which with good design never reach objectionable proportions. As these stresses are, in all cases, at right angles to those resulting from the pressure of water in the pipe, their existence does not affect the strength of the pipe directly, although they may tend to bring out any weak points, and accumulating with other stresses they may have been factors in the production of such few breaks as have been noted with steel pipe.

These temperature stresses must be frankly recognized and provided for at every point. Overlooking them may mean disaster. The details of the joints and connections also must be very carefully studied and must be good.

The design of steel pipe has not been standardized in the same way that cast iron pipe has been standardized. More skill is required to reach a good and safe design with it. Fortunately the early lines of steel pipe were designed by able men, and the precedents then established were good. It is for us to see that they are maintained, and that necessary precautions are not omitted.

Pipe 30 inches in diameter can be successfully riveted in the field, although

the space inside is rather small for good workmanship; 36-inch pipe is more easily riveted, and this marks the ordinary minimum limit of steel pipe as now made.

At Springfield, for the river crossing, two lines of 30-inch steel pipe were used. Steel pipe was selected in this case, not because it was cheaper, but because it was believed to be stronger and more reliable for an especially difficult service.

Generally speaking, with increasing size, cast iron pipe increases in cost more rapidly than steel pipe. The saving to be made by using steel pipe as compared with cast iron is relatively small for 36-inch pipe, and would probably disappear with 30-inch pipe under present conditions, increases rapidly for 48-inch and larger pipe. This is true even with the methods of calculating the thickness of wall of cast iron pipe that have been used in the past. When Prof. Talbot's work is taken into account, and the increased thickness logically called for is allowed on the larger sizes of cast iron pipe, the difference will become greater.

There is a limit to the thickness of castings that can be advantageously used. A large pipe with very thick walls is probably relatively less strong and reliable than one with thinner walls, because the internal stresses in the thick casting are greater and there is more likelihood of its going to pieces from its own internal stresses, acting either by themselves or in conjunction with other stresses from external sources that may come upon the pipe.

When all these matters are taken into account, large cast iron pipe for considerable pressures will increase in cost almost as rapidly as the square of the diameter of the pipe. In other words, there will be relatively small saving by using very large lines of cast iron pipe as compared with several lines of smaller diameter.

In our practice in the last years we have seldom considered the use of cast iron pipe more than 36 inches, or at most 42 inches, in diameter. In nearly all cases we have felt that it was better business to use steel pipe where most capacity was required, or otherwise to divide the line.

Sometimes we have surrounded steel pipe with concrete, thereby adding to its stability and durability. The cost has been increased, but not so as to equal that of cast iron pipe.

Methods of Keeping Records of Improvements to Established Water Works Plants.*

By Charles Carroll Brown, Consulting Engineer, Indianapolis, Ind.

THIS is a large subject, too large to cover in one paper, and so this paper will be restricted to the statement of a few of the underlying principles, some suggestions of methods of classifying and recording items and some examples of the practical application of these principles and methods.

The word "improvements" in the title to this paper is intended to cover new construction of extensions and enlargements, replacement of out-grown or out-of-date materials, apparatus, machinery or structures, and repairs and maintenance of existing structures.

My interest in the subject is largely due to the difficulty in the way of determining the value of a plant for purposes of sale or purchase or for determining equitable rates.

The records are naturally classified into records of disbursement, records of the stock pile and records of construction cost.

1. The accompanying standard form of "'Cash Disbursements and Voucher Record" separates the expenditures for construction, general expense and fixed charges, and maintenance and repairs, and would be sufficient for the financial records were it always possible to distribute the items in vouchers at once to the proper columns under the above-named general headings. But some of the new material and apparatus purchased is put into stock and is drawn from as required, so that the distribution of items, if made accurately, must be made when the material is drawn from stock. When accurate records are required, there must, therefore, be some method of taking care of this stock account and making this supplementary distribution before the closing of the books for the annual report.

In a small plant it is possible to determine, with very close approximation to accuracy, the probable destination of each

*A paper before the American Water Works Association.

CASH DISBURSEMENTS

Line No.	Construction: Distributing System: Street Mains: Pipe	Valves	Hydrants	Tools	Gas. Hose Incidentals	Specials	Labor	Total	Service Connections: Materials	Labor and Incidentals	Meters	Setting	Total	Pumping System: Service and Standpipe: Materials	Labor and Incidentals	Buildings: Materials	Labor and Incidentals	Boilers, Engines, etc.: Materials	Labor and Incidentals	Total	Personal Acct.	Vouchers: Date 97	Top No.	Ex. No.	Sub. Fol.	Amount	To Whom Issued	Line No.
			Amounts forward from previous page																									
1	193 50																					1/2	43			193 50	M J Drummond	1
2		27 50																					44			27 50	Eddy Valve Co	2
3	/																						45			93	J Builders Iron Foundry	3
4							26					3 50										1/3	46			143 50	Geo Thornton Secy	4
5																						1/3	47			5	Bell Telephone Co	5
6																						1/3	48			5	Geo Thornton Secy	6
7											130											1/3	49			130	Thompson Meter Co	7
8											130											1/5	50			130	Hersey Mfg Co	8
9																					100	1/7	51		21	100	Western Fuel Co	9
10							15					3 50			5				6			1/9	52			143	Geo Thornton Secy	10
11																					1000		53		10	1000	Central Trust Co	11
12																							54			8	Journal Printing Co	12
13																						1/10	55			65	Municipal Engineering Co	13
14																												14
	193 50	27 50					41				260	6			5				6		1100					2043 50		

AND VOUCHER RECORD

General Expense and Fixed Charges: Salaries and Labor	Office Expense	Stationery and Printing	Taxes	Interest	Misc's	Total	Maintenance and Repairs: Pumping System: Fuel: Lbs.	Cost	Supplies	Salaries and Labor	Misc's	Total	Reservoirs and Standpipes: Materials	Labor and Incidentals	Total	Distributing System: Street Mains: Pipe and Supplies	Valves and Hydrants	Labor and Incidentals	Total	Service Connections: Materials	Labor and Incidentals	Total	Meters: Materials	Labor and Incidentals	Total	Buildings and Grounds: Materials	Labor and Incidentals	Total	Remarks	Line No.
																														1
																														2
																	93													3
56										45								6					7						Pay Roll	4
	5																													5
	5																												Postage	6
																														7
																														8
																														9
56										45				1 50				10									2		Pay Roll	10
																													Interest	11
		8																												12
		65																											Set of Books	13
																														14
112	10	73								90				1 50			93	16					7				2			

item in each voucher and to make the distribution in books made according to the accompanying form, where the voucher totals are entered in the right hand column on the left hand page, so that this form is ample and sufficient for such small plants.

In larger plants where a considerable stock account is carried, the distribution must be made later, as stated, and the method of making this distribution and of keeping the records thereof is the subject of this discussion, which will be confined to a few of the items, perhaps enough to show the principles, and give indications of the methods of applying them, that may be devised.

All purchases of materials and apparatus may be carried to a stock account, and all labor on repairs and handling of materials may be charged to the same account and the distribution may be made under the heading of the stock account. This method of keeping the records might almost entirely eliminate the "Construction" section of the accompanying forms, and some accountants may prefer this method of treating the vouchers.

A large proportion of the purchases may be assigned immediately to the proper division, whether "Construction" or "Maintenance and Repairs", and only such portions as go to stock need be charged to the "'Stock" account. Also, the pay rolls and labor accounts can often be so made up that the labor of handling materials and apparatus into and out of the stock piles can be charged accurately to the "'Stock" account. This latter distribution is not always easy to make, for it requires a detailed record of the distribution of time of men, for which few Water Works Superintendents have prepared forms. In such cases arbitrary rules for charging such labor and materials are sometimes made.

The blank columns between the "Vouchers" columns and the "'Construction" columns on the left hand page of the accompanying form may be used for this "Stock" account, using only one column therefor, or using two, one for materials and the other for labor, as may be preferred.

2. A special stock account will then be kept, to which these items will be charged, and whenever anything is taken from stock it can be credited to the stock account and distributed to "Construction" or "'Maintenance and Repairs" in columns with the same headings as those in the "Cash Disbursements and Voucher Record". When the books are closed before the annual report, the stock account can be closed first, and the footings of these columns can be transferred to the corresponding columns in the "Cash Disbursements and Voucher Record." The totals of these columns will then represent the materials, apparatus and labor actually used during the year. If stock began with zero and ended with zero, the sums of the distribution columns would equal the total of the "'Vouchers" column. Ordinarily, however, this balance cannot be made without bringing in the balances from the stock account, and the "Cash Disbursements and Voucher Record" must have a trial balance before the column footings from the "Stock" account are transferred to it. The one or two "Stock" columns in the "Cash Disbursements and Voucher Record" must, of course, be included to produce the balance.

3. An engineer's record of materials and labor used and expended on each job of construction and repairs is very desirable. It can hardly be compared with or closed into the "Cash Disbursements and Voucher Record". Neither can it be directly connected with the "Stock" account, unless that account includes all purchases and all labor on construction and repairs. But the accounts can be so classified that proper balances can be made and the entries and distributions thoroughly checked.

In showing the method of making the records of improvements, it is necessary to consider the "Cash Disbursements and Voucher Record", the "Stock" account and the engineer's records, the latter often being the records of the foreman in charge of the job in smaller plants, in which the Superintendent also acts as the engineer.

I am indebted to a paper on "Pipe System Records" presented to the Indiana Engineering Society by Dow R. Gwinn, Superintendent of the water works at Terre Haute, Ind., and to Mr. Gwinn himself for much of the material presented in exemplification of the operation of the plan above proposed and for most of the forms of record discussed.

For either large or small stock accounts the card system of keeping records will be found most convenient. The following form of card is suggested for keeping account of the material passing through the stock account and not directly to a construction job, the headings being modified from those used by Mr. Gwinn to fit them for use with the record book above shown, 5 by 8 inches being a convenient size:

1st column—Number of Voucher (corresponding to that given in the "Cash Disbursements and Voucher Record"). It may be necessary to enter this number after the date of receipt of the material in stock, if the voucher is entered in the book after the stock is received.

2nd Column—Date of Receipt. This date is the date of receipt of the material in stock and may differ from the date of

Order No. _____ Terre Haute, Ind. June 3, 1910

TERRE HAUTE WATER WORKS CO.

12th Street, from Collett Street, to Indiana Street

Size of Main 8" Weight per foot 52.1# Made by USCI P&P CO. Addyston Cost, per ton, Pipe $24.70 Specials 2 1/2 Bells Look N

Work Began June 7, 1910 Work Finished June 9, 1910 Water Turned on June 9, 1910

Location of Main

At N.line Collett	21	ft.	2	in.	W	of	E	property line.	Depth from surface of street to top of pipe	4	ft.	8	in.
100' N.N."	"	21	ft.	4	in.	W	of	E	"	"	"	"	"	"	"	"	4	ft.	10	in.
200' N.N."	"	21	ft.	3	in.	W	of	E	"	"	"	"	"	"	"	"	5	ft.	0	in.
At S.line Indiana	21	ft.	0	in.	W	of	E	"	"	"	"	"	"	"	"	"	4	ft.	6	in.

Specials

LOCATION	SIZE	MEASUREMENTS
S.E. 12th & Indiana	8 x 6 tee	21 ft. 0 in. W of E property line, and 5 ft. 4 in. S of S property line.
		ft. in. of " " " ft. in. of " "
		ft. in. of " " " ft. in. of " "
		ft. in. of " " " ft. in. of " "

Hydrants

LOCATION	NAME	OPENINGS	SIZE	YEAR MADE	WATER TURNED ON	ORDERED BY CITY OF TERRE HAUTE
S.E. 12th & Indiana	Mathews	2 - 2 1/2"	4"-5		June 9, 1910	May 24, 1910

Valves

LOCATION	NAME	Size	Locks	Open to R. or L.	Turns to Open	Open or Shut	Well or Box	MEASUREMENTS
S.E. 12th & Indiana on hydt. branch	Eddy NY	6"	W	Right	28	Open	Box	18 ft. 2 in. W of E Prop. line 5 ft. 4 in. S of S Prop. line
								ft. in. of Prop. line ft. in. of Prop. line

Length of Pipe

MAINS Size	MAINS No. Feet	HYDRANT BRANCH Size	HYDRANT BRANCH No. Feet	INTERSECTION BRANCHES Size	INTERSECTION BRANCHES No. Feet	TOTAL NUMBER FEET	SERVICE PIPE LAID House No	SERVICE PIPE LAID Long or Short
8"	381'	6"	5'8"					

Summary

Approximate weight of Pipe laid _____ tons . . . . . $ _____

" " Specials used _____ lbs. . . . . _____

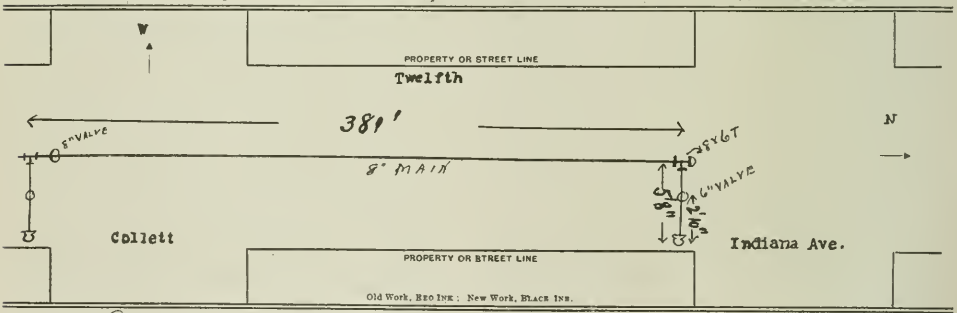
" " Lead used _____ lbs. . . . . _____

Labor, ... _____

Hydrants _____ Valves _____ Drayage _____ . . . . . _____

Hemp _____ Valve Boxes _____ Sundries _____ . . . . . _____

Cost of Labor, per foot _____ Total Cost, per foot _____ Total, $ _____



Approved: Tom Glynn

Peter Kelly Foreman.

the voucher of corresponding number.

3rd Column—Date of Removal. This date is the date the material is removed from stock and charged to some particular item of construction, renewal or repair. These two date columns might be combined in one, but it is easier to catch the differences in the fourth column if the two date columns are carefully used.

4th Column—This column gives, opposite the voucher number and date of receipt in first and second columns, such information about the materials received as is wanted. Ordinarily this information would be greatly abbreviated, using a standard set of abbreviations, and this column, a wide one, taking at least half to three-quarters of the width of the card, would tell the maker of the material, the place at which it was delivered and, if all the materials purchased pass through the stock account, the statement of the account to which it should be charged, whether new construction, maintenance and repair, or re-construction.

Opposite the date removed, given in the

third column, there would be entered in the fourth column the description of the material taken from stock and the place or job to which delivered and to be charged, and a statement of whether it is construction, maintenance and repair, or re-construction.

5th Column—This, a narrow one, would give the number of pieces, pounds, gallons, etc., received or removed.

The 6th column would give the number in stock, beginning on the first line with the amount brought forward and adding or subtracting the amounts in the 5th column, according to whether they were received into or removed from stock.

If the material, such as pipe, is counted in lengths and paid for in pounds or tons, the 7th and 8th columns may be added, one giving the weights and the other the cost, into or out of stock.

Thus the 5th and 6th columns would give the number of pieces, lengths of pipe, etc., the 7th would give either the total weight of the number given on the same line in the 5th column and the 8th the total cost, or the 7th column might give the average weight and the 8th the price per unit. The latter is probably the more convenient.

One of these cards will be made for each separate item in stock; one for each size of cast iron pipe, for each size of wrought iron pipe, etc.; one for each size and each combination of sizes of crosses, tees, reducers, etc.; one each for lead, leadite, oakum, cement and each other item of supplies.

Mr. Gwinn has a very complete form for reports of engineer or foreman in charge of each job of work, which he styles "Record of Pipe Laying". It covers both sides of a card 10⅛ inches wide by 12½inches long, which is folded in thirds for convenience in carrying by the foreman. Copy of this card is included herewith. As much as possible of the information to be entered on the card is written into it on the typewriter before it is given to the foreman, so that the writing to be done by him can be reduced to a minimum.

In a sample card kindly copied by Mr. Gwinn from an actual office record, the information supplied by the office includes the location, size of main, weight per foot, manufacturer, cost of pipe per ton and of specials per pound, position of bells, year, location of main except actual figures of distance from line noted and depth, location of tees, hydrants and valves except the measurements, and a sketch showing the existing main, names of streets and points of compass. The foreman inserts the measurements, the description of valve, the lengths and sizes of pipe, the date water was turned on, and adds the new work to the sketch, with measurements and sizes. All of this side of the blank is copied on sheets of a loose-leaf record book, and these sheets are filed in a definite order, so that they can be easily found by one familiar with the geography of the city.

The foremen's reports, themselves, are put in special envelopes, with all other data collected with reference to the job, and are filed in the same order as the leaves in the record book.

On the back of the sheet appears under "Remarks", in the sample under description, a detailed description of the street grade as a guide for the excavation, being filled in at the office. The foreman enters on proper lines the number of pounds of lead or leadite used, the number of joints made in each size of pipe, the number of hours of each kind of labor, the charge for hauling by outside party and for company's teams, the number of lengths of pipe used and the number and size of specials used, such as tees, valves, valve boxes, plugs, hydrants, etc.

This record seems to be complete enough so that the office force can check up the stock accounts by comparing these foremen's reports with the cards on which the stock account is kept and with the vouchers for materials and labor. The totals of company's labor can be compared with the pay rolls, for further check. These all make it possible to distribute the items from stock to the proper columns, and to fill any deficiencies in information as to distribution of labor items.

For the plants for which the "Cash Disbursements and Voucher Record" is sufficiently detailed, the summary of the stock account thus checked and amplified by comparison with the reports of construction, can be reduced to a series of items corresponding with the headings of the columns in the "Cash Disbursements and Voucher Record", and at the end of the year the sums of the columns can be taken and these sums transferred to that record and added to its totals, as suggested early in this paper. These totals will then contain all the transactions for the year, although the final sums will not check with the total of the voucher column, unless, as above stated, the stock account stands at the end of the year exactly as it did at the beginning.

There is one item which is not covered by the above description. In case pipe and specials are taken up and returned to stock for future use elsewhere, the foremen's reports should show such facts and the stock account should show the receipt of such material. This material would not appear in the Voucher Record, since nothing has been paid for it, unless possibly the cost of handling it should be charged to it. In any event, the cost

would be small and would reduce the average cost of that class of material in stock. When used, the proper account must be taken of these facts, according to the policy of the managers of the plant.

It may be profitable to discuss the question of policy to some extent. The main purpose of keeping the records described is to determine the actual cost of the construction and maintenance of the plant. It is sometimes difficult to determine whether a certain charge shall be made to construction or to maintenance, and how to manage the credits and charges when a transfer is made from one part of the system to another, whereby one part is

TERRE HAUTE WATER WORKS CO. Filing No.

RECORD OF MAINS, SPECIALS, VALVES AND HYDRANTS

Twelveth Street, from Indiana Street to Collett Street

Size of Main 8" Weight per foot 52.1" Made by U.S.C.S.P.&F. Co. Addyston Cost per Ton $ 24.10 Cost Specials 2½c Belts look N

Ordered by City May 24" 1910 Work Started June 7" 1910 Turned on June 9" 1910 Leaded Joints

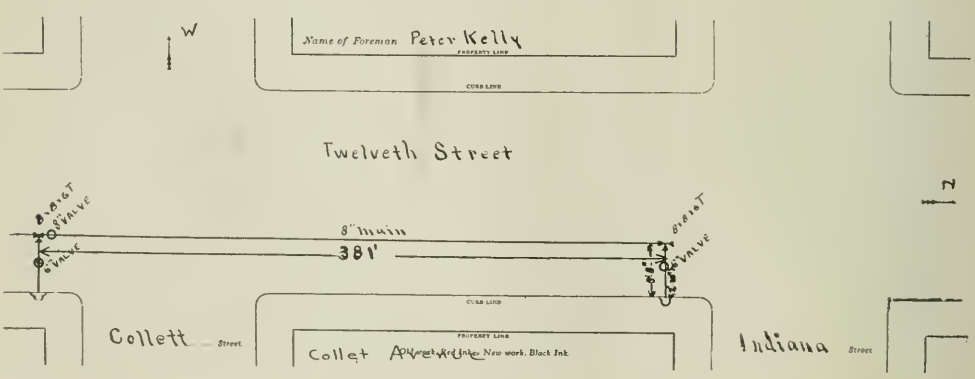
Location of Main		Ft.	In.	Of		Property Line of	Surface St. to Top of Pipe	Other Measurements and Remarks
	At S Line of Indiana St.	21	0	W	E	12" St.	4' 6"	
	At Center of Block							
	At N Line of Collett St.	21	2	W	E	12" St.	4' 8"	
	At 100 N.W. "	21	4	W	E	" "	4'-10"	
	At 200 " "	21	3	W	E	" "	5'-0"	

Location of Specials	General Location	Description	Ft.	In.	Of		Property Line of	Ft.	In	Of		Property Line of	Remarks
	S. E. 12 & Indiana	8X6 Hyd. T	21	0	W	E	12" St.	5	4	S	S	Indiana	

Fire Hydrants	General Location	Name	Size	Diameter Branch Pipe	Openings	Year Made	Water Turned on	Ordered by City	No.	Valve in Branch	Remarks
	S. E. 12" & Indiana	Mathew	4"-5'	0"	2-2½"		June 9/10	May 24/10		Valve	Removed from Wabash line

Valves in Mains	General Location	Name	Size	Looks	Open to R. or L.	Turns to Open	Well or Box	Ft	In	Of		Property Line of	Ft.	In.	Of		Property Line of
In Hyd. Branches	S. E. 12" & Indiana	Eddy Wy.	6	W	Right	20	Box	18	2	W	E	12" St.	5	4	S	S	Indiana

Costs, Etc	Mains Size	Mains No. Feet	Hydrant Branches Size	Hydrant Branches No. of Feet	Interest Branches Size	Interest Branches No. of Feet	Total Number Feet	Approximate Cost Pipe	Lead and Yarn	Drag and Sundry	Labor per Ft	Total per Ft	Specials	Hydrants	Valves	Valve Boxes
	8	381	6"	5'-8"												



discontinued or replaced and another part is repaired or an addition is made, using the materials from the discontinued part. This brings in the question of the present value of the plant, through consideration of the depreciation of the part thus used a second time. If the object of keeping the records is kept clearly in mind at all times, these difficulties will be largely removed.

Assuming perfect judgment and supervision in design, construction and maintenance, the actual value of a plant at any date is its first cost, plus the additions and minus its depreciation. The first two items can be determined exactly by means of the system of records described. The latter cannot be determined exactly, and we must make as close approximations thereto as may be possible. We are interested particularly at this moment in the treatment of the re-use of material taken out of a plant and used later in another part thereof, that the actual cost and actual value may be maintained and no fictitious addition or subtraction be made.

For example, an 8x6 cross is put into a line and charged to the cost of that line. It remains in place for ten years and for some good reason is then removed from the line. The labor cost of removal is possibly charged to new construction in connection with a new branch put in, or possibly to maintenance and repairs in case the removal was in connection with the repair of the original line. The cross is then put in stock, where it remains for say three years. It is then put into a new line.

If the total cost of the system is the important consideration, the voucher record will show nothing but the cost of taking out and re-locating the cross, doubtless concealed in a construction or repair pay roll. The cross will be charged to stock and again credited to stock, and charged to the new line without any valuation.

This method of taking care of the case brings in chances for discrepancies, unless considerable care is exercised. Thus, in an inventory taken when the cross was in stock, it might easily be counted at full value if not at original cost. Again, a Superintendent who keeps the full records of construction described above will hardly be satisfied with the report of cost of the new line, because it is less than the actual value by the value of the cross, and so will not compare with the cost of other lines without special explanation.

For the purposes of this record, therefore, the cross should be charged at its value to the new line. This value is not its original cost, but its value after depreciation is charged off, either according to fixed rule or according to actual value as estimated from examination. If depreciation is properly charged off each year, the former method of determining the value will keep the closer to the book value of the plant. So far as the stock account is concerned, there is no difficulty, for the charge in and credit out will balance. There will be less chance for discrepancy in the inventory. To avoid interference with the total value of the plant, it will be necessary to credit the line from which it was removed with the same value that is charged to the new line. This should be done for the benefit of the valuation of the plant as derived from the summary of the costs of the individual lines kept in the records described. For when a line is removed it is no longer of value, and the construction record of the line should show a credit to offset the original cost, or the value at the time of removal if depreciation has been charged off. When part of a line is removed, it is reduced in value by the value of that part of the line.

The form of engineer's or foreman's report is such that this question of depreciation need not be considered in detail in making up that record. The actual pieces, lengths, etc., are there recorded, with dates and such other information as may be valuable in determining actual cost or actual value. These latter computations are made in the office and can be made at leisure or when the occasion demands. More nearly accurate allowance for depreciation can be made if it is made on each section of the work, the rates of depreciation varying with the character of the construction.

It does not seem difficult, therefore to provide in the blanks and books described, with some slight modifications, for entries in about the following order:

1. The voucher will be entered in its proper column in the "Cash Disbursement and Voucher Record."

2. Its items will be distributed to the columns under "Construction," "General Expense and Fixed Charges" and "Maintenance and Repair," all items of materials and cost of handling them to be entered first in columns under "Stock" and then distributed either directly in the "Cash Disbursement and Voucher Record" or in a supplementary "Stock Record" whenever the distribution of stock is actually made to "Construction" or "Maintenance and Repairs."

3. Enter the materials as received on the proper cards in the card record of materials in stock, and credit out as delivered on the job the materials taken out of stock and put into the work. Enter and charge materials taken out of old construction and put into new in the same manner. Give with each entry, in the proper column, the source from which the material is received, its price, total

cost, freight and handling charges and labor being separated if possible, data on which to estimate depreciation, in short, all possible information about the material received; the place to which material is delivered, its cost, handling charge, source, price per unit paid or charged as the case may be, or average cost in case the exact cost of the particular piece of material cannot be exactly identified.

4. Enter on the engineer's or foreman's report of construction all data regarding amount of material used and kind, labor and item to which to charge it, dates, etc., as required on the form presented; also data regarding materials removed and returned to stock in full. Blank space may be left expressly for this or it may be entered under "Remarks," with proper note on the other side of the card.

5. In transferring the foreman's report to the record book all the blanks due to lack of information or greater ease of computation in the office than in the field should be filled in and the actual cost of the job should be worked out completely before records are lost or memory becomes dim.

In the process of transferring the foremen's reports to the record book provided for them, the stock record can be checked, and in part at least the Voucher Record can be checked. The vouchers for the construction or repair will, of course, carry their distribution on the back and can therefore be entered directly in the "Cash Disbursement and Voucher Record."

The distribution of "Stock," if made separately on the supplementary "Stock Record," must, of course, be made in cash, as it is a distribution of vouchers or their equivalent, and these cash figures should check with the figures used in the computation of cost of construction of each job.

The annual summary of the "Stock Record" thus distributed may be transferred to the "Cash Disbursement and Voucher Record" to show the totals for the year if such supplementary record is kept.

This treatment of records makes it possible to draw a more definite line between construction items and maintenance and repair items. Materials are usually easy to charge to one of the two groups, but labor is not so easy, especially when that labor is used in reconstructing a line, part of which is truly new construction and part replacement of old structures worn out or outgrown. If, now, the old material is charged back to stock, at its value at the time, or is written off entirely in case its value is zero, and the new material replacing it is charged at its value, new, the increase in value of the plant due to the replacement is attributed to the line into which it is put, and thus gets into the plant, and the record shows the increase in value. The amount of depreciation allowed on the old material shows the amount of the new construction that should be paid for out of the depreciation fund which every plant should have. The remainder should be paid out of the fund for new construction. If the work done is not in any sense new construction, but is reconstruction or repair of old structures, then the whole net expense would be charged to the depreciation fund. In other words, all new material which increases the first cost of the plant, i. e., adds to its capacity or convenience of operation, should be charged to new construction, and all material which does not so add to the first cost, but simply restores the former ability of the plant to do the duty for which it is designed, should be charged to maintenance and repairs and paid for out of the funds provided for that purpose or to take care of depreciation, as the policy of the company regarding these funds directs.

Labor items are not so readily distributed, and numerous arbitrary rules have been devised to take care of them, for example, to charge the materials to new construction and the labor to maintenance and repairs, on the assumption that this will come near being equitable. If, however, the same principle is applied to labor that is applied to materials, the number of doubtful cases will be greatly reduced.

It is true that most of the new materials supplied in the doubtful cases will belong properly to repairs, but consideration of the principle that what adds to the first value of the plant is new construction and what only restores that first value is repairs, will enable the superintendent to make the distribution of his labor account as easy as that of his material account.

To be sure, the foreman cannot always distribute the time of his men exactly between the two classes of items, but he can give some information about it, and the engineer, if he does it before the matter gets cold, can form a very good judgment of the proportionate distribution of the labor account on the particular job between the two classes of items.

More time is taken in the discussion of these peculiar items, because, while proportionately very small, they are very troublesome. The principle can be applied readily in the ordinary case and is usually properly followed. Only one or two classes of cases are suggested because they are used only as examples of the application of the principle. Each one can make his own decision regarding

each such case which arises, if he will remember the principle and check up his decision to see whether it has been followed throughout.

On back of "Record of Pipe Laying" is the following statement of materials and labor:

Leadite used, 115 pounds.
No. 4-inch joints.
No. 6-inch joints, 4.
No. 8-inch joints, 35.
No. 10-inch joints.
No. — inch joints.
Total hours—
Foreman, 10.
Caulkers, —.
Laborers, 255.
Total, —.

Drayage: 33 pieces 8-in. pipe hauled by transfer company; 9 hours for teams in company's employ.

1 8x8x6 tee.
1 6-in. valve.
2 valve boxes.
1 8-in. valve.
1 8-in. plug.
5 feet 8 inches of 6-in. pipe.
1 Mathews hyd. 4-in., 5 feet.
32 joints 8-in. pipe used.

City Planning in Vienna.

MUCH attention has been given to the city of Vienna by reason of the recent consideration of the question of town planning and the physical improvement of cities. Statement has been made that Vienna is the most perfectly planned city of Europe. Maps, models and photographs showing the arrangement of streets, the grouping of buildings and the general appearance of portions of the city have been shown at the various city planning conferences in support of this statement.

The most noticeable features of the city plan are the three concentric girdles, the inmost of which, known as the Ringstrasse, was formerly occupied by a wall surrounding the inner town. The accompanying diagram shows the western part of the inner town and Ringstrasse. This circular street, with the radial intersecting streets, forming main arteries of traffic, and the grouping of the public buildings about the Hofburg, or Royal Palace, are the points of merit which are claimed for Vienna's city plan.

The Ring is made up of a number of sections bearing distinct names, as follows: The Schotten-Ring, so called from the monastery of Scottish Benedictines situated in the old town near by; the Franzens-Ring, in front of the Royal Theater; the Burg-Ring, in front of the Royal Palace; the Opera-Ring in front of the Royal Opera; the Kaertner-Ring; the Park Ring, in front of Stadt Park, and the Stuben-Ring. The remaining space completing the Ring is occupied by the Franz Joseph Quai, on the Danube canal.

The criticism has been made that the Ringstrasse offers an obstruction to transportation and to the development of the city. Just why the latter should be true is not apparent, unless it is a factor of the question of transportation. And with the number of transverse streets shown, it is evident that transportation may be readily taken care of. However that may be, the opportunity offered for the effective grouping of buildings, and the space allowed for inner town parks and gardens, should compensate for a slight check on transportation.

The grouping of public buildings is an admirable feature of the Vienna plan. All of the group situated with the Franz Joseph Quai as a background are made to center upon the Hofburg and the two imperial museums, which, with the outer Burg Platz and the Maria Theresia Platz, form two inclosed squares. The squares form the central feature of the two symmetrical rings fronting on the Franzens-Ring and the Opera and Kaertner-Rings. The original conception of this plan is due to the German architect, Gottfried Semper, and the building was carried out by Baron Hoolnauer. Photograph 2 shows the Maria Theresia Platz, as seen from the royal stables, with the Art Museum on the right. The formal garden is characteristic of those within the Ringstrasse.

In laying out the other main side of the Ring an attempt has been made to place an important building in the center of each, on the side of the inner town. The placing of the Theater and the Opera centrally on either side of the Hofburg is in accordance with this plan, and is an excellent piece of symmetrical grouping; but owing to their distance apart, this feature cannot be fully appreciated when viewed from the Ring. Photograph 3 shows a portion of the Opera-Ring. As will be noted from the plan (Photograph 1), the wing along the Franzens-Ring has been more developed than the other; the Parliament building, the University and the Rathaus (city building) having been

THE WESTERN PART OF THE INNER TOWN AND RINGSTRASSE

constructed on this first named portion, making it symmetrical upon the Theater as a center. Some idea of the effect of this grouping may be gained by reference to Photograph 4, which shows a view looking towards the Hofburg from the Rathaus across the Franzens-Ring and Volks Garden. The intervening space between the Rathaus and Franzens-Ring is laid out in twin parks, with a central avenue between. The criticism has been made that the large forest trees in these parks tend to obscure the effect of the grouping of the buildings, as viewed from form Karls Platz and a garden in front of the Technical School.

The grouping of buildings on other portions of the Ring does not follow any consistent plan, such as characterized those previously mentioned, but it is hoped that in time a more orderly arrangement may be effected.

The base of the Ringstrasse is formed by the Franz Joseph Quai, a portion of which is shown in Photograph 5. It is in the form of an irregular curve, following the line of the Danube canal, and with the convex side towards the Hofburg, ex-

2. THE MARIA THERESIA PLATZ, VIENNA,
Taken From the Royal Stables.

the ground level. This effect is not noticeable from the photograph shown.

A great deal more intelligent treatment is evident in the wing dominated by the Theater than in that of which the Opera forms the central feature. In the latter, the two important groups formed by the Academy of Graphic Arts with the Schiller Platz and the Technical School and the Karls-Kirche have been allowed to become widely separated by blocks of office buildings, so that their effect is entirely lost. The Technical School and Karls-Kirche, facing the Artists' House and the Music Society, form an independent group, the Vienna river, which flows between them, having been covered to cept near the Schotten-Ring, where a slight bend in a contrary direction forms a small park. The buildings along the Quai form a fairly level horizontal line, and the banks have been improved after the manner shown by concrete walls. The bridges are by no means remarkable, but are consistent and artistic.

There are, as may be noted, a number of small parks or town gardens within the Ring. These vary from the small patches in front of the Palace of Justice to the wooded park known as Stadt Park. They are in most cases laid out after the formal fashion noted in the photograph of the Maria Theresia Platz, but in some cases they are characterized by the pic-

3. THE OPERA RING, VIENNA.

4. THE FRANZENS-RING, VIENNA.
Looking From the Rathaus Towards the Hof-Burg.

turesque "English manner," with well-grown, unrestricted trees and rich, thick foliage.

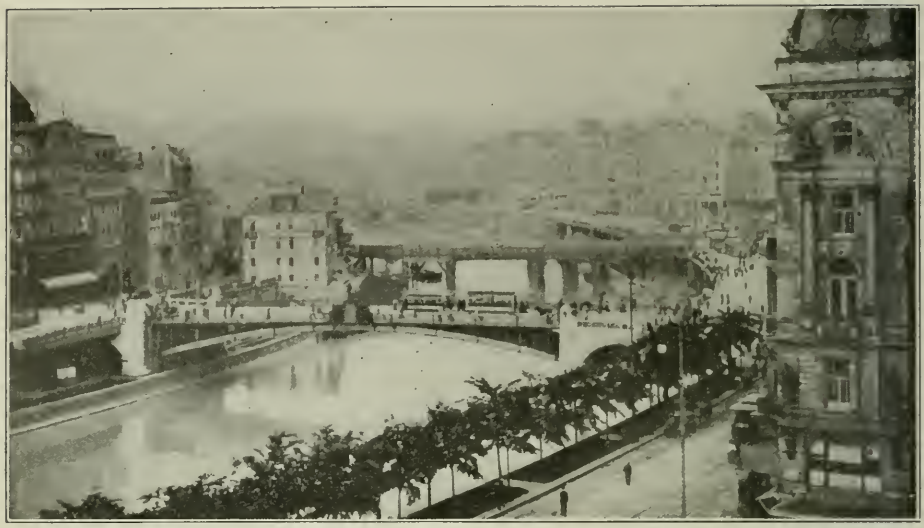
The Prater, not shown on the plan, is the true town park of Vienna. It is divided into three parts; the first, known as the Wurstel Prater, contains the milder amusement devices found at our state and county fairs; the second is dominated by the rotunda, erected for the exposition and preserved for exhibition purposes; and the third consists of natural woods and water. Extending through the Prater is a tree-lined drive three miles long, known as the Haupt-allée. Photograph 6 shows the Haupt-allée, or long drive through the Prater, with the walks and parking at either side. A number of other gardens and parks owned by the city or belonging to the royal grounds may be found throughout the city, but, excepting the Prater, they are of value only for their appearance, as they offer no such advantages as are demanded in American parks, namely, shade and plenty of green grass.

The streets are generous in width and well planned, though in some cases wretchedly paved. The accompanying cross-sections show a number of the principal streets. As will be noted, ample space is provided in each case for all classes of traffic. The Ringstrasse is symmetrically laid out, with roadways on either side of the central roadway and separated from it by a tree-lined promenade and riding track. The effective means of screening the sunken railway along the Gurtelstrasse may be noted. The idea of avoiding the unsightly appearance generally noted in street railway appurtenances is shown in Photograph 7, flower baskets having been provided on the trolley standards and an artistic design for the base substituted for the straight, unsightly pole so common in America.

The Stadtbahn, or Metropolitan railway, follows along the canal for five miles. The promenade, which forms a part of the gardens, is immediately over the railway and supported on columns in such a way that one side, towards the canal, is open to provide light and air.

Taken in its entirety, the Vienna plan has much to recommend it to those interested in city planning, though in some cases the carrying out of ideas has been unsuccessful.

7. ORNAMENTED TRAMWAY POLES, VIENNA.



5. THE FRANZ JOSEF QUAY, VIENNA.

6. THE LONG DRIVE THROUGH THE PRATER, VIENNA.

Sewage Disposal with Respect to Offensive Odors.

By George W. Fuller, M. Am. Soc. C. E., New York City.

Odors in the Collecting Sewers.

FOR some thirty years, beginning with the comprehensive report outlining the scientific principles on which European sewers were built, prepared by Mr. Rudolph Hering, at the request of the National Board of Health, it has been known that sewage should be brought to the point of disposal as promptly as possible and with minimum opportunity for putrefaction of stranded materials within the pipes. As knowledge has increased with respect to decomposition of sewage, it has become clearly recognized that additional care should be required in the collection of sewage from the standpoint of guarding against objectionable odors. The principal features requiring attention are as follows:

Ventilation of Sewers.

It is highly important to provide fresh air in the underground channels comprising the collecting pipes of the sewerage system, in order to maintain bacterial processes, as far as possible, on an aerobic basis. Lack of ventilation tends to promote in places a needlessly rapid exhaustion of the oxygen dissolved in the water supply as it is discharged into the sewers, and it is not difficult to find some cases where objectionable odors exist in the collecting sewers themselves. In some instances good ventilation will correct this difficulty. In other instances the fault is a fundamental one in the design of the sewers, and one which ventilation will help, but not cure.

House Connection Traps.

Where plumbing fixtures are provided with suitable traps and with vents leading to a soil pipe that extends above the roof of the building, no good seems to be accomplished by putting a trap on the house connection, through which the sewage passes from the building to the street sewer. Connections that are so trapped frequently have their interior coated with a slimy deposit in which more or less putrefaction is taking place, whereas similar connections that are not trapped have the sides of the pipe comparatively free of deposits and bacterial growths. There are still some differences of opinion in this regard, but it is believed that it would be of material assistance for plumbing codes hereafter to call for untrapped house connections.

Non-subsiding Velocities.

Many of the old sewers, both in this country and abroad, were of such a design that the sewage flowing through them deposit more or less of the suspended matters, including some of a fecal nature. This is probably much more true of the so-called "combined" sewers, which convey both storm water and sanitary sewage, than of the separate sewers, which convey sewage alone. This is noticeable where large storm sewers, in times of rain, discharge very foul matters for some minutes following an increase in flow.

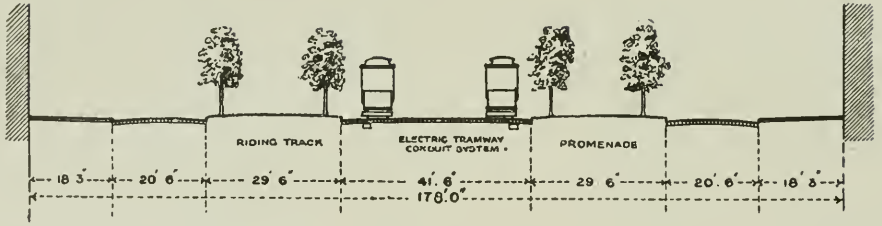
Smooth Interior Surfaces.

Where the interior surfaces of the sewers are rough and where projecting masonry allows deposits to be built up in front of it, it is quite possible that in these deposits anaerobic conditions are established in a manner and to an extent that is much more conducive to objectionable odors than is generally considered in this country by those who deal in reasonably well-designed and constructed sewers. The formation of enzymes or soluble fermentation compounds may do much more towards bringing about putrefaction than hitherto realized in this country. German investigators believe this to be true where they have studied old combined sewers.

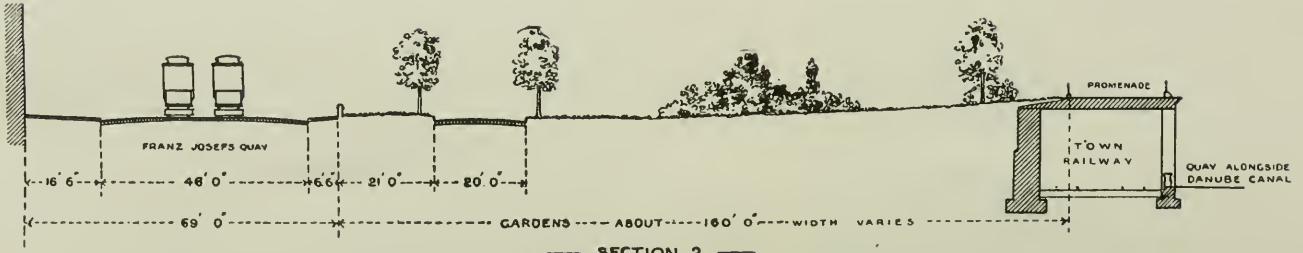
Flushing.

First-class sewerage practice calls for the installation of flushing tanks at the head of all sewer lines in order to wash away stranded particles of fecal matter in those portions of the sewer where the ordinary flow is insufficient to maintain a scouring velocity. Such flushing is sometimes done by automatic flush tanks discharging every few hours. From the bateriological standpoint, it would probably suffice to have flushing done once a week during the cold season of the year, and say twice a week in the warmer season of the year.

In the larger sewers it is, of course, not feasible to flush readily from automatic flushing tanks, but it is practicable to keep decomposing organic matter from remaining lodged upon the interior surface of the sewers. This may be done either by hand, with a hose or flush gates or by putting in stop-planks at manholes and allowing sewage to build up in depth until a head is established sufficient to create a scouring velocity.



— SECTION. 1. —
THE RINGSTRASSE



— SECTION. 2. —
FRANZ JOSEFS QUAY

8. SECTIONS OF VIENNA STREETS.

Fire Protection by Gas Engines.

ALMOST important question, which must be considered by the small town, the coast communities and the large or isolated manufacturing plant has reference to fire protection. The matter of expense enters in pretty much every such case. In addition there is the problem of an adequate water supply under sufficiently high pressure. It is possible—and this has been proven in numerous instances—to solve the whole problem by means of a powerful pumping plant operated only when necessity arises. One of the most notable cases is that at Coney Island, the New York pleasure resort.

The buildings at this place have been and are very inflammable. In consequence of the conditions, fire policies were limited to 10 per cent. of the value, and a 5 per cent. rate charged. The location is distant from the general fire system of the Borough of Brooklyn. To maintain an adequate number of fire steamers to cope with the possibilities would have entailed a very heavy expense. An abundance of water was, however, available. First, there was the city supply, and second, the salt water of the immediate vicinity, if such water could be used. The question of power was, of course, important. What was needed was a solution of the power question which would enable a large total of power to become available quickly, and would entail little or no expense in the intervals when not required. This problem was successfully solved by using gas engines and supplying them with the ordinary illuminating gas. A large gas-holder was situated nearby; with this suitable connections were made. Three Nash gas engines of the vertical, three-cylinder, four-cycle type were installed. The cylinders are 13¾ inches in diameter, and the stroke is 16 inches. When these engines are run at 260 revolutions per minute, a horsepower of 175 is developed by each. This is accomplished with gas of but 590 B. t. u. per cubic foot, by using only 17.4 cubic feet per brake-horsepower per hour. The valves of one cylinder in each engine are arranged to permit the use of compressed air to start it off. There are two separate air compressors. One of these has its own small gas engine. There is in addition a series of storage tanks for compressed air, with capacity equal to starting all engines twice. It will be seen from the foregoing that very adequate provision has been made for starting up. In fact, the men in charge do not have to exert themselves at all. The compressed air starts the engine forward, operating through one of the three cylinders. The other two cylinders quickly develop power from the gas—in one or two revolutions, in fact. The engine is put into full operation by gas in 20 seconds. All three engines and the whole plant can be put into full operation in about 2½ minutes. It will thus be seen that we have a source of driving power which becomes available in a very short space of time.

This power equipment drives a very efficient pumping plant. This consists of three triplex, double-acting piston pumps built by the Goulds Manufacturing Co., Seneca Falls, N. Y. Each of these pumps is directly connected to one of the gas engines, and forms with it a water-handling equipment independent of the other pumps. The pistons have a diameter of 12 inches and a stroke of 14 inches. There is a capacity of 40.3 gallons at each revolution of the three-arm crank shaft. As the ordinary angular speed of the crank shaft is 38.5 revolutions per minute, we readily calculate a pumping capacity of 1,551 gallons per minute per pump. Each pump is driven by a pair of pinions which engage with spur gears arranged on the ends of the crank shaft. The gear ratio is 1.5. The suction piping has a diameter of 12 inches; the discharge piping is 10 inches.

Each of the pumps has a by-pass permitting the discharge to pass into the overflow pipe. While the engine is getting under way, the by-pass valve is open; but when the full speed is attained, this valve is gradually closed by an electric motor. The valve is opened or closed in 20 seconds; the electric motor automatically stops when its work of opening or closing the valve is completed. The total capacity of the three pumps is 4,650 gallons per minute. The pressure is 150 pounds per square inch at the pumps. For a hydrant seven-eighths of a mile away the pressure falls only to 140 pounds, when the full capacity of the plant is employed. The area protected totals about 65 acres. There are numerous hydrants so distributed that the whole energy of the pumping plant can be concentrated upon any one block of buildings. These hydrants have 2½-inch hose connections, and are joined to the service mains by 8-inch piping. The full capacity of 4,650 gallons per minute can be developed with 15 to 20 streams.

City water is brought into the plant. In addition there is suction connection with an adjacent body of water, known as

Coney Island creek. This water is salt and the supply is inexhaustible. In case the city water should fail the salt water supply could be utilized.

This pumping plant seems to have been admirably conceived. It is economical, as it is operated only when needed. The attendance expense is low. It can be started up with great rapidity and with great certainty. If the city water fails, the Atlantic ocean can be called upon. The whole plant need not be put into operation if the situation does not require it. And the starting up of the plant does not depend upon the muscular strength of the persons at the moment in attendance. A great volume of water per minute is available. Further, the streams are very powerful, so that considerable heights can be reached. A pressure of 140 pounds per square inch is equivalent to that obtainable from an elevated tank or standpipe 320 feet high.

The high pressure pumping plant had a real try-out in 1907 during a serious conflagration. The total capacity of the plant is, as has already been stated, 4,650 gallons per minute, with a pressure of 150 pounds per square inch at the pumps. The 1907 blaze made demands that were just about equal to the capacity. A considerable number of steamers were summoned to the spot, but only a few were really used, according to *The Sun*. The cost for gas for the 16-hour run of the plant amounted to $58.00.

A few weeks ago a great conflagration broke out. The plant has never been increased in capacity by additional units, although the size of the place has grown and the total length of mains has been much extended. It is said that as many as 30 connections were made during this blaze. There could be but one result—a great loss of pressure. Some of the electrical people have seemed to take the absured view that the plant could be expected to furnish any quantity of water at high pressure that an emergency might happen to require. A gas-driven pumping plant cannot be expected to do more in such a situation than an electrically driven one. No reasonable person finds fault with a two-horsepower electric motor that is unable to furnish 4 or 5 horsepower. The manufacturers of the pumps made inquiry of the commissioner's office of the department of water supply, gas and electricity of New York City upon this subject. Deputy Commissioner J. W. F. Bennett replied that the pumps worked satisfactorily during the fire, and that the overdraft "necessarily resulted in the reduction in pressure shown on the charts." The capacity is such as to supply 15 or 18 hose connections with high-pressure streams. To get 30 or 36 such streams is not difficult; it is only necessary to duplicate the plant.

GAS METER AND ENGINE FOR HIGH PRESSURE FIRE SERVICE.

The Width of Street Pavements.*

1. THE INFLUENCE OF SUB-STRUCTURES—By George S. Webster, C. E., Chief Engineer, Philadelphia, Pa.

IN considering the subject of street widths and their subdivisions, the necessity for providing ample space to accommodate the sub-structures needed to meet the requirements of modern city life cannot be overlooked. Underground circulation is as necessary to modern municipal life as surface circulation, and the problems involved in its installation and maintenance have become exceedingly complex and difficult as the demand for such service has increased. Surface traffic may be shifted entirely from off a street temporarily, in cases of emergency, without inflicting any great hardship, but the underground service, once installed, becomes permanent, and any derangement or interference with it ofttimes seriously affects large areas. The great tendency in all our large cities, especially in America, to concentrate business activities at some central location (to create civic centers) has demonstrated the total inadequacy of the street surface to supply space to meet the problems of passenger transportation. It is therefore essential to plan in all our large cities to carry the thousands of people, who daily congregate, for business or pleasure, over railway lines constructed either above or below the street surface. The space required for the foundations to support elevated roads, or the area of the street cross-section necessary for subways, in addition to the sewers, water and gas pipes, telegraph and telephone conduits, pneumatic tubes, pipes for the conveyance of steam, hot water or refrigerating compounds, vaults and tunnels, cannot be found except in streets of considerable width.

The sub-structure congestion occurs not only in the business districts but also along the lines of all main arteries of travel leading from the heart of the city to local centers of manufacturing or business interests. In the central and older portions of the city of Philadelphia many of the streets in the regular system are but 50 feet wide, with a few diagonal avenues 60 feet wide. The widths of these streets are insufficient not only for surface travel but also for the sub-structures which must be placed in them. This congestion is particularly marked at the street intersections. In the replanning of these portions of the city it is found necessary not only to provide for widening existing highways but also to lay out and open additional avenues, and to enlarge intersections to meet the demands for sub-surface structures as well as for surface uses. This increase in street width has been gradually accomplished on Chestnut and Walnut streets, in the business section, by placing the streets upon the official plan with 10 feet greater width and requiring all new buildings to recede to the new line, paying to the owner at the time of reconstruction any damages that may be sustained. By this method the cost is not burdensome to the city. The widths of a number of important diagonal avenues leading through local business centers are being increased in like manner.

In the growth of a modern city the number and character of underground structures is constantly increasing and changing, and it is probable that the future will see the present ones supplemented by others for purposes now scarcely thought of. This ever increasing demand for space under the street surface makes it therefore necessary that the available cross-section be utilized to the best possible advantage. This in a measure can be accomplished in the city of Philadelphia, by grouping the structures as closely together as possible, but a much better method would be by the construction of one or more lines of subservice galleries, of sufficient size to accommodate all future structures, preferably one on each side of the street, close to the curb lines, thus doing away with the usual form of conduit construction and avoiding the necessity of continually opening the street surface and interfering with the proper maintenance of the paved areas. Such galleries might, when old streets are widened or new avenues opened in the built-up portion of the city, be advantageously constructed and maintained by the municipality, and at least a portion of the cost covered by rental charges to public service companies which should be required by law to place their structures in them and to pay a proper rental therefor.

The prevailing custom in many cities of allowing vaults to be constructed under the sidewalks of the street and extending to the surface, results in the occupation of a large percentage of the available cross-section of the street and interferes seriously with the laying of other underground structures. The disadvantage of

* From papers before the Conference on City Planning.

allowing construction of this kind is now being realized in many of our cities and such constructions are wholly prohibited on main thoroughfares. Since 1902 it has been unlawful in Philadelphia to construct or reconstruct any vault under the sidewalks of the streets unless the outside top of the vault be at least four feet below the established grade of the sidewalk over the same, the purpose being to reserve this four feet of space for conduit and tube construction. All persons receiving permits to construct vaults are required to enter into agreement that the city shall in no case be liable for any claim for damages for the reoccupation and use of the whole street or any part thereof to the house line, for public purposes.

In the city of Philadelphia the location of underground structures of every character is determined by a board of highway supervisors composed of the chief officers of the various bureaus of the city government having charge of the municipal underground structures. This board is vested with the full power, not only to grant original locations to companies authorized by law to lay pipes and conduits, but also to direct their removal and relocation whenever the public good demands it. For the purpose of enabling the board to act intelligently upon all applications, a recording and drafting department is maintained where all underground structures are platted and their sizes, depths and distances from the curb or building lines shown upon plans of uniform size drawn to a scale of 20 feet to the inch. Each structure is colored with a conventional tint so that it may be readily followed on the plan. All applicants for permits to locate pipes, conduits or other sub-surface structures are required to obtain plans from the department records showing, as far as practicable, all existing structures in the street, also the location which they desire to occupy. A charge per linear foot is made by the city for such plans and information and the cash receipts are considerably more than necessary to maintain the force in the drafting room and the field inspectors who are sent to see that the locations granted are followed and to systematically make measurements of, and report all structures of every character met with in the excavation. By this means the plans are constantly being checked, and where necessary, corrected. In all cases where electrical conduits are laid by public service corporations, the law requires that one conduit shall be provided and laid at the expense of the company for the use of the city.

2. THE INFLUENCE OF SURFACE CONDITIONS—By George W. Tillson, Consulting Engineer Borough of Brooklyn, N. Y.

THERE is probably no one thing in the make-up of a city that is of as much importance as its streets. This refers to their location and width, as well as their surface treatment.

As this article will deal principally with surfaces, it will be taken for granted that the streets themselves have been properly located. Their surfaces, however, cannot be intelligently considered without giving some attention to width. But before taking this matter up in detail streets must be divided into three groups, namely, wholesale, retail and residential. It is understood, too, that it is often difficult to tell in advance to which group any street may belong and also if it will remain in that group permanently.

Streets have two functions, one to give light and air, and the other to facilitate travel, both pedestrian and vehicular. For the former purpose the width should be varied according to the height of adjacent buildings, and for the latter according to its traffic.

As a rule a wholesale street is not a thoroughfare and consequently a width that will fill local requirements is ordinarily sufficient. For the same reason a wholesale street is used but little for pedestrians, so that a wide sidewalk is not necessary. A wide sidewalk is even a detriment, for, as in most cities goods are taken from the buildings across the walks to the trucks, these walks should be no wider than is absolutely necessary. If then the minimum width of a wholesale street is taken at 60 feet, how this width should be divided as to roadway and sidewalks is the question. In such a case as this it is easier to assume the vehicular than the pedestrian wants, and if the former be satisfied without at the same time interfering with those of the latter, the entire solution ought to be fairly successful.

Only one tier of trucks can be located in front of any building at one time. The large trucks in Manhattan, backed up against the curb, occupy 13½ feet. If the opposite side of the roadway be similarly used, 27 feet in all will be blocked to transient travel on the street. As a general proposition the width of the roadway should be sufficient to allow trucks to load on both sides without impeding the lines of traffic each way. If the roadway be assumed at 40 feet, and 13½ feet be occupied on each side, there would be left a width of 13 feet in the center, which

will be hardly enough for this purpose. It is probable that both sides of the street will not be occupied all the time, especially with the largest size trucks, so that traffic could move fairly well in both directions under these conditions; but if the sidewalk width should be reduced one foot more on each side, making a roadway of 42 feet, there would be no serious obstruction to the traffic. This reasoning is based upon the idea that the entire street width is for the public and is not to be taken up by areas, stoops, railings or obstructions of any kind.

On retail business streets different conditions govern, as both the walks and pavement are used by many transient persons for a short time only, and they are constantly coming and going; but as the vehicles deposit their passengers on the sidewalk, it should, relatively in proportion to the roadway, be wider on a retail than on a wholesale street. Fifth avenue in New York City is the greatest retail street in this country. It is 100 feet wide and until recently has had a 40-foot roadway, with sidewalk spaces 30 feet wide. Areas and stoops, however, were permitted to a width of 15 feet, thus reducing the actual width available to the public to 70 feet. In 1909, between Twenty-fifth and Forty-eighth streets, the curbs were set back 7½ feet on both sides and all encroachments removed to a distance of at least 2½ feet from the building line, causing to be taken down stoops that had been in use for more than fifty years. The entire operation gave a roadway 55 feet wide, with available sidewalk widths of not less than 20 feet each. This new roadway width permits three lines of travel on each side of the street without interference, and the sidewalk width is ample for present needs. The result here has been so satisfactory to every one that the same treatment will be continued as far north as Fifty-eighth street and also applied to many other of the wider streets and avenues where the traffic is congested.

On residential streets the questions that have been discussed are determined more by sentimental than utilitarian principles. So much depends upon whether the street is, or is not, solidly built up and whether the buildings set back of, or on, the property line.. The residential streets of Manhattan are 60 feet wide, with roadways of 30 feet. This leaves sidewalk spaces of 15 feet, but as stoops are allowed to project 5 feet, the width available to the public is only 50 feet. The question immediately arises—if this width is sufficient, why should the city condemn (or expropriate) and pay for a width of 60 feet for public use? A width of 30 feet is sufficient to allow the ordinary vehicle to turn around easily, and as a general proposition is sufficient for a residential street. On short and unimportant streets even this can be reduced without disadvantage.

New York's Economical Refuse Disposal.

Until the appointment of William H. Edwards to the street cleaning department of Greater New York, the disposal of garbage and refuse was both uneconomical and unsanitary. Refuse and ashes were indiscriminately piled in scows and hauled out to sea, or to tide lands which had been bulk-headed and dumped.

The first step taken by Commissioner Edwards was to strictly enforce the separation of refuse into the following divisions: 1. Garbage. 2. Ashes. 3. Rubbish.

The garbage was sent to Barren island, where a private company converted it into commercially valuable products; the rubbish was picked over by Italian laborers, employed by contractors who paid the city thousands of dollars for the privilege, beside donating many more thousands in free labor, as a partial return for the valuables found in land partially submerged or of a marshy composition.

Estimated amounts of garbage removed from boroughs of Manhattan, Bronx and Brooklyn, 5,000,000 cubic yards.

Price paid by city for actual removal to scows, per year.	$ 65,000.00
Paid for removal of dead animals, offal, etc., per year..	50,000.00
Price received for refuse salvage, per year.....	$ 90,000.00
Estimated value of free labor provided by refuse salvage contractor in trimming (picking over) city's scows, per year	50,000.00
Estimated yearly revenue to city through reclamation of land with city refuse and sale of ashes	50,000.00
Total	$190,000.00
Estimated revenue	$190,000.00
Estimated expense	115,000.00
Total estimated net revenue.	$ 75,000.00

The Illumination of Streets and Open Places.

By E. Darrow, Consulting Engineer.

THROUGHOUT the country generally there is a fast arousing sentiment towards securing a better illumination of streets and public places, and in many cities down-town lighting associations have been formed by the merchants, who are carrying to successful completion more effective and artistic street illumination.

It has been realized by the merchants and property-owners that new lighting systems were badly needed, particularly in business districts, and the outcome has been signally successful in several instances.

To the electrical or illuminating engineer the following list shows the more prominent electrical units which are available for exterior service:

1. Carbon filament lamps in clusters or arches.
2. Metalized filament lamps in clusters or arches.
3. Tantalum filament lamps in clusters or arches.
4. Tungsten filament lamps in clusters or arches.
5. Nernst lamps with one to six glowers.
6. Enclosed arcs D. C. and A. C.
7. Magnetite arcs.
8. Flaming arcs—Regenerative arcs.
9. Carbide arcs.
10. Quartz tube.

The efficiency, quality, color and other characteristics vary widely.

The watts per candle are greater in the carbon filament type, viz., 3½ watts per c. p., and least in the quartz tube .25 watts per c. p.

Many of our smaller municipalities have shown a marked preference in business districts for arches with lamps of classes 1, 2, 3, 4, and spaced from 100 to 200 feet apart. A good illustration of this character of service is in evidence at Norfolk, Va.

After a careful investigation and many suggestions as to the design of construction, flat steel arches with a span of 40 feet, a width of 12 inches and a rise of 48 inches, were placed across the street and attached to the iron street railway poles every 100 feet.

Ten series incandescent center space suspension outfits were attached to each arch. The lamps and reflectors alone hang below the arch, and the whole presents a very attractive appearance in daytime. Each arch is lamped with 60-watt 6.6-ampere street series lamps, with automatic cutouts and radial wave reflectors; the neat, yet substantial design, the graceful and symmetrical curve of the arch, have been a source of much favorable comment.

Cities of first grade in the past have depended largely on series arcs for their street illumination.

The characteristics of series arc systems, both D. C. and A. C., need no special comment here.

The practice has been to space these lamps in single units from 300 to 600 feet apart. Four ampere arcs of this type have been in use in Cincinnati for the past eight years, the city's contract calling for lamps which consume 300 watts at the lamp terminal. These lamps are spaced in the downtown districts about every 300 feet.

The illumination from these four ampere arcs has been an absolute failure, and has given Cincinnati the name of being one of the poorest lighted cities in the country.

The four-ampere 300-watt arc is an absolute failure as an illuminant for public places or thoroughfares.

The failure in Cincinnati was also accentuated by the fact that the lamps were hung too close to the ground; viz., about 12 feet, and by the mechanical imperfection of the lamp, which caused excessive outage.

(The new system of ornamental street lights in use in Cincinnati was described in MUNICIPAL ENGINEERING, vol. xl, p. 203.—ED.)

The enclosed arc lamp is essentially an American development ,and its long burning without trimming feature, in spite of decreased efficiency, has made it a popular form of street lamp.

Series enclosed lamps consuming approximately 500 watts and using 6 to 7½ amperes, have been found quite satisfactory and reliable when properly spaced, and hung at proper height.

Metallic flame arcs, employing some mineral element in the carbon electrodes to increase their luminous efficiency are enjoying an increasing use in this country on account of their high efficiency and excellent lighting qualities.

They have the disadvantage of requiring more frequent attention and trimming, and to correct the difficulty practically the same series of remedies have been applied as in the infancy of the old open-arc lamp.

A comparatively new type of lamp, first

brought out in Europe, but also now made in this country, is the regenerative arc lamp. In this lamp the vapors from the impregnated electrodes are carried down and reintroduced into the arc chamber, increasing the luminous efficiency of the flame. Such lamps may be operated for 75 hours without retrimming.

Metallic flame lamps of the magazine type, using one or more metallic electrodes, have been deservedly successful for their long hours of operation, low cost of maintenance, excellent efficiency and good distribution. Late improvements in this type of lamp gives promise of a steadier quality of arc, and an increasing time between trims of at least 200 hours.

Toledo, Ohio, has installed during the past year a large number of these arcs at street intersections, and in the downtown district on the main thoroughfares have erected two-lamp standards every hundred feet or so, and although they have procured a flood of white light, it is overdone, not artistic in any sense, and exceedingly unpleasant to the eye.

St. Louis, Mo., is now installing, through the efforts of its Downtown Lighting Association, a system of street illumination, using magnetic arcs. On Broadway they have adopted a five-lamp standard. The effect is brilliant, but as a permanent installation it seems to the writer in extremely bad taste.

On all other business streets one-light standards are used.

The Broadway system has been grossly overdone, and gives an unpleasant glare. The three-light standards are spaced approximately sixty feet apart, or ten standards (each of three lamps) on every block, making a total of thirty arc lamps to the block.

The other business streets are illuminated by four magnetite arcs at each street intersection and one intermediate lamp on each side midway. This latter arrangement gives six lamps per city block.

The most artistic and effective illumination is the plan adopted by Indianapolis, Ind.; Des Moines, Iowa; Seattle, Wash.; Los Angeles, Cal., etc.

In Indianapolis the main thoroughfare has six standards eighty-four feet apart, each standard having five individual one-hundred-watt tungsten lamps, each enclosed in a light ground glass or thin opalescent outer globe.

Washington street is an extremely wide thoroughfare, yet with this system a newspaper can be read at any point with ease. The illumination is very even, well distributed, and the effect exceedingly pleasing to the eye.

Similar effects have been obtained in the other cities mentioned above.

The carbide arc and the quartz tube are too little known yet to have a definite place assigned to them.

Titanium carbide is the cathode, and placed below an anode of copper, the latter being inactive and not wasting away appreciably. The light is almost pure white with a slight tinge of yellow. It belongs to the flame type, and its efficiency increases with current density and with increasing length of arc. On test a lamp of this character with three amperes, 103 volts and one-inch arc, consumes only 0.228 watts horizontal candle power.

The mean spherical c. p. was 535 and the mean hemispherical c. p. 738.

The efficiency curves show that the titanium carbide arcs are most satisfactorily operated on constant current circuits, hence this lamp should be particularly adaptable to existing street series circuits.

The European quartz tube lamp is heralded as giving a flood of beautiful golden white light faintly tinged with green, and so brilliant that one can read ordinary print 300 feet from this lamp.

This little lamp has a quartz tube about four inches in length and envelopes an illumination of 4000 mean spherical candle power.

The claims of this newcomer are an efficiency of 0.25 per candle, no renewals of electrode, no cleaning of globes and no delicate parts to get out of order. This is almost an ideal specification, but in its present form is not adaptable for interior illumination.

It has a powerful actinic action and in its development of ultra violet rays it is liable to produce burns on the flesh. As an exterior illuminant it seems to be ideal and any harmful qualities disappear when hung 15 or 20 feet from the ground.

The lamp as now manufactured is for direct current only, but could easily be adapted to mercury arc rectifier circuits.

(a) As a resume and final word in this section, the tendency in arc lamps is away from enclosed ones of relative small candle power and low efficiency towards arc lamps of higher candle power such as the magnetite and carbide.

For artistic effects the Luxolabra type seems to have many attractive and exclusive features.

(b) The suspension of arc lamps of the higher candle power should not be less than 20 feet from curb to bottom of lamp.

When there are no trees the position of lamps relative to curb is not so important, but in suburban districts, which are wooded, the only satisfactory solution is the middle of the street. In downtown districts it is almost universal practice now to have the standards and lamps

on curb lines. Height of Luxolabra type 13 feet 6 inches to top of globe.

(c) Spacing of units necessarily varies with the money available in each instance and the effect that is desired.

Business districts vary to extremes. St. Louis, with thirty metallic flame arcs per city block, has probably the maximum illumination, while many cities think they have sufficient light with 1500-watt arcs each 400 feet. A fairly well lighted section would have not less than two arcs at each street intersection and two midway in block.

The spacing of the Luxolabra type of units varies from 60 to 100 feet or from four to eight standards on each side of the street to a block.

(d) Arc lamp systems are lighted on either moonlight schedule or the all-night schedule. The first means approximately 2,100 hours of burning and the second 4,000 hours per annum. The moonlight schedule is gradually becoming obsolete.

It is difficult to make any comparison of costs, as the characteristics of the various systems are manifestly different. Watts per square foot mean nothing if you do not consider quality. Again it is hard to compare cost of glare with illumination.

Perhaps it may be well to give here some of the prices which municipalities and merchants' associations are paying for street service.

Cincinnati—4-ampere, 300-watt enclosed arcs, $60-$72.

Toledo, Ohio—300-watt, Magnetite, $48.

Boston, Mass. — 500-watt, Magnetite, $118.

St. Louis—500-watt, Magnetite, $80 (approx.).

Indianapolis—500-watt, A. C. enclosed, $62.50.

Indianapolis — Luxolabra standards, $1.05 per foot front per annum.

Des Moines, Iowa—Luxolabra standards, $1.58 per foot front per annum.

With the increasing use of powerful arcs there has become a needless distress to the man in the street. When used for street illumination such arcs should be swung high. The time has passed when high candle-powered arcs should be thrust in the faces of pedestrians.

Such glare as in evidence on Broadway, St. Louis, or Summit street, Toledo, is a garish display, and is most unpleasant to the public, and should be regulated. The glaring arc can be, and ought to be, abolished.

Dr. Steinmetz has pointed out in an admirable manner that eye fatigue is a question of the energy imparted to it by the radiations received. Further the blue end of the spectrum possesses much less energy than the red. Also with the greater divergence of color in more recent light sources, and the greater knowledge of the physiological effects of radiation in general, the importance of considering the color of light sources on purely physiological grounds has become a serious matter.

Frosted globes and diffusing reflectors tend to prevent troublesome reflection and mitigate glare.

At the February, 1910, meeting of the Illumination Society of London there was an extended discussion of glare. Although the discussion was somewhat indefinite, there was nevertheless a general and wholesome condemnation of glaring illumination.

In consideration of costs, renewals, upkeeps, etc., it is useless to attempt comparison on basis of charges per lamp of a rated candle power. Open arcs, D. C. arcs enclosed, Magnetite arcs, valued as street illuminants, may vary over 150 per cent.

The National Electric Light Association recommended the selling of illumination rather than energy, but unfortunately we have evolved no principles by which the effective lighting on two streets can be compared on a basis of illumination. A service contract for a particular and specified illuminant, which has been previously tried out, is the only safe way to handle street lighting contracts at present.

It will be noted that the Norfolk, Va., decorative arc lighting for each 400-foot block required 3,000 watts at lamp terminals.

In Cincinnati four 300-watt enclosed arcs to the block, or 1,200 watts at lamp terminals.

In St. Louis Broadway's special illumination shows 30 300-watt metallic flame lamps, or a total of 9,000 watts per block.

In Indianapolis, with its Luxolabra standards twelve to a block, each standard containing 5 100-watt tungsten lamps, represents 6,000 watts of energy.

Thus it will be seen how widely typical installations vary as to quantity and quality.

Under the usual conditions attendant on aerial line construction, with average spacing of lamps, the cost per lamp erected exclusive of station equipment varies from $60 to $100.

In underground districts the construction costs may reach as high as $250 per lamp.

The cost of installing the 667 Magnetite lamps in St. Louis was close to $140,000. The depreciation in this equipment is easily 10 per cent. per annum.

Maintenance costs in the curb-line system of illumination, such as adopted in Des Moines, Seattle and Indianapolis, are about as follows per 1,000 hours of burning, each post five 100-watt tungstens:

(a)	Five lamps	$ 5 00
	Glassware	2 00
	Cleaning and attendance	1 00
	Depreciation	2 00
	500 k. w. h.	5 00
		$15 00
(b)	Maintenance D. C. enclosed arcs:	
	Carbons and trimming	$ 1 20
	Repairs and globes	50
	Depreciation	2 00
	500 K. W. H.	5 00
		$8 70
(c)	Maintenance metallic flame arcs:	
	Trimming	$ 7 50
	Repairs and glassware	2 00
	Depreciation	2 00
	500 k. w. h.	5 00
		$16 50
(d)	Maintenance flaming arcs:	
	Carbon and trimming	$ 9 50
	Repairs and globes	2 00
	Depreciation	2 00
	500 k. w. h.	5 00
		$18 50

The energy required for these various systems of lighting varies from 6 to 60 k. w. per mile roadway.

An ordinary 60-foot roadway has about 315,000 square feet to the mile, and with the American average of 5 to 10 k. w. per mile, this allows a ridiculously low wattage per square foot.

The consummation of energy per square foot per foot candle is about as follows:

Tungsten lighting .....0.3 to 0.5
Enclosed D. C.....0.25 to 0.45
Metallic flame .....0.06 to 0.13

The radius of action for tungsten Luxolabra types is

about .....100 feet
Enclosed arc lamps.....125 feet
Metallic flame .....300 feet

From the above considerations it would appear that due to the combined influence of public sentiment, first costs and maintenance charges, series burning constant metallic flame lighting units are driving all other types of illuminants from the residence and suburban districts of our municipalities. However, there is a strong trend in business sections of our progressive cities to artistic lighting effects, as is evidenced by the many attractive forms of arches and curb-line lighting which have been developed in the past eighteen months.

The enclosed D. C. and A. C. arc is a back number, and considering its few advantages, its wide adoption was remarkable, particularly as it was so inefficient as an illuminant.

Likewise flaming arcs have a somewhat limited field on account of their color element.

A few years ago a lamp-post was simply a thing to hang a lamp on. Today it is considered a factor of municipal enterprise and intelligence, and our Downtown Merchants' Lighting Association has done much to set a new standard for artistic and efficient public lighting.

WIRING FOR ELECTRIC LIGHT.

General Considerations.—For interior installations the tungsten lamp has proved itself superior to all other illuminants, not only making a great reduction in cost of lighting, but, if properly installed, allows a maximum of eye comfort.

The market now affords an ample supply of well-designed and artistic fixtures, which allow the lamp to hang vertically. Correct illumination can only be figured or determined on a basis of the lamps being in a vertical position.

As a second consideration, the proper selection of reflector and shade-holder is important. The extensive, the intensive and focusing types of holophane shades are each designed to give a satisfactory illumination under certain definite conditions, viz., position of outlet, size and height of room, etc.

Third, it is a well-known principle that the direct rays from the filament should not be allowed to strike the eye, and hence care should be taken in selection of the proper shade, together with proper frosting of bowl. Lamps should not be frosted all over, neither be entirely clear.

Fourth, the importance of keeping the glassware and reflecting surfaces clean can not be too strongly emphasized.

Lastly, the mounting height of outlets or fixtures is an important consideration.

All the above considerations must be carefully analyzed by the illuminating engineer, and on these primary factors he must determine the correct wattage lamps for each outlet. The number of watts per square foot of surface to be illuminated depends on type of service, and varies from a minimum in halls of 0.2 watt per square foot to a maximum of 1.5 watts in stores.

Interior Work.—The different methods of wiring which are now approved by the National Board of Fire Underwriters may be stated as follows:

1. Exposed work.
2. Wiring in molding.
3. Wiring concealed.

Class I.—This method of construction has the following advantages to its credit, viz., cheapness, accessibility and durability. This character of work is appropriate only when appearance is not an objection, and also where there is a minimum liability of mechanical disarrangement. Practically this type of wiring is now only used in mills, factories and for heavy feeders.

Class II.—This class of work is used to extend existing circuits in buildings where the initial installation was concealed. Molding should be used on exterior of walls and ceilings where there is danger of mechanical injury, but should not be used in damp places. It has been a popular form, because it is convenient and in appearance an improvement over open work.

Class III.—Embraces (a) wire run in rigid conduits; (b) in flexible metal conduits; and (c) armored cable. Rigid conduit comes in gas pipe sizes, and if unlined can be bent without injury. Flexible conduit of the Greenfield type is having an ever increasing field. Owing to its flexibility it can be used in many places, which prohibit the rigid construction. It is particularly useful for completed buildings. Conduit work costs double the open work and a third more than molding.

Armored cable is likewise used much in completed buildings, where it is undesirable to disturb floors, and has the advantage that it can be fished between floors and partition walls. It is slightly less expensive than conduit construction.

A choice of two-wire or three-wire system is largely dependent on service conditions. If the source of supply is always to be 110 volts, then a two-wire system must of necessity follow, but if 110-220 volts is available or a probability of its being available, then a three-wire system should be provided.

The difference in installation costs is not marked, although theoretically the saving of copper should be quite marked in a three-wire system.

In planning a wiring installation for a building the engineer should gather all data which will affect the wiring system, such as: kind of structure, space available for conductors, source of supply and details affecting cost.

Outlets.—This is a matter which is closely allied to the general subject of illumination, and requires much care and thought. Some of the salient points which go to determine the location of outlets: (1) type of fixture to be used; (2) decorative and architectural effects desired; (3) requirements to suit taste of owner. Having determined the number and character of service for the outlets, the next step is to locate the distributive center or centers. Some of the conditions governing this are: (1) location of isolated plant or service entry to building; (2) accessibility; (3) have centers as near as possible to the risers; (4) there should be a sufficient number of cutout cabinets so that branch circuits may not be too long; (5) remember the rule that no branch shall have over 660 watts. Having determined the system, the location of outlets and the distribution centers, the branch circuits may now be laid out. In fireproof buildings it is an invariable practice to lay the conduits between the top of the concrete and the rough flooring, notching any sleepers that may cross the path of the conduits.

All peculiarities of construction must be known in advance before laying out the conduit lines, as this many times is the determining factor in circuit layouts.

The maximum allowable loss in a branch circuit is 1 per cent. At this point a plan and elevation of the feeder circuits and risers should be made, the loads calculated and copper figured, so as to give a loss between service connection and distributing centers of not to exceed 1 per cent.

It may be found advisable to relocate the centers in order to keep the total losses within the limits previously determined.

From the earliest days of electric lighting it was a necessity to have a protection device in the various circuits to protect it from overload, short circuits, etc. For this purpose a piece of fusible metal was provided, which was copper-tipped and known as a link fuse. This was superseded to a large extent first by Edison fusible plug cutout, and more recently the cartridge type of enclosed fuse has been developed.

The distribution centers are now equipped with fireproof lined cabinets, having knife or push button switches and cartridge fuses for each branch circuit.

For street lighting systems the type of wiring mostly used is called the series system. Most arc lamps used for street illumination are constant current lamps. This type has held sway because of the simplicity and the saving in copper.

The disadvantages are the high voltage necessary, and the fact that a single open circuit puts 50 to 100 lamps out of service.

In conclusion it may be appropriate to call attention to the increasing importance of artistic effect and structural ornamentation. Lighting today has passed beyond the wavering glimmer of a tallow dip or oil lamp, and should be made an instructive feature in the progress of science and art. Thus far artistic progress in illumination has made little progress in the United States, but of late, particularly in cities west of the Alleghanies, there is a growing disposition to pay more attention to decorative art and architecture, and a creditable line of new art designs in fixtures are now obtainable.—*Michigan Technic.*

EDITORIAL COMMENT

Competition In Public Contracts

COMPETITION IN PUBLIC CONTRACTS.

Major Cassius E. Gillette has had much experience in his work in the Engineer Corps of the U. S. army with the letting of contracts and was for a time active in improving the methods of governing the letting of contracts by the city of Philadelphia. He has had quite a varied and concentrated experience with dishonest contractors and has made a serious study of the methods of controlling them. In a recent paper before the American Society Engineering Contractors he has reported many of his experiences as illustrations of the desirability of devising provisions in the laws of the states which will make such practices difficult, if not impossible. He makes the following suggestions of matters to be embodied in the laws covering public purchases of supplies and public constructions.

1. All expenditures of public money for supplies and construction work in amounts of $100 and more shall be by formal written contracts. Purchases of less than $100 may be by written proposal and written agreement, duly filed.

2. No bid shall be asked until an actual appropriation of funds has been made for the work or supplies, and before bids are asked for public contracts, official itemized estimates of the cost of the proposed work shall be made and permanently filed in the office of the public official who invites the bids.

3. All public contracts involving an estimated cost of $5,000 or more shall be advertised in three local papers having the largest sworn circulation, and in at least one trade journal of suitable type, sufficiently far in advance of the opening of bids to give the most distant bidder in the state a reasonable opportunity to see the notice in time to submit a bid after due investigation.

Contracts for less than $5,000 shall be so advertised that every bidder residing in the municipality (or county) in which the supplies are to be delivered or work done shall have a reasonable chance to see the advertisement or receive the notice in time to submit a proper bid, and every official charged with the duty of purchasing supplies or making contracts must keep in his office lists of all dealers or bidders who request their names to be put upon such lists whenever such work and materials as they specify shall be desired by the official, and notice sent them in ample time to submit bids.

Purchases and contracts involving less than $100 may in emergencies be made by telephone, provided at least three bids be obtained, and the bids and prices be scheduled for public inspection, all the bids and the acceptance to be confirmed in writing.

In case of contracts for yearly supplies to be delivered as needed purchases shall be by single items. The lowest bidder for each item shall be given the contract for that item, provided that if any bidder does not thereby secure items for which the estimate for the year in question or the actual use for the preceding year shall amount to at least $100, such items may be awarded to the bidder who bid the next lowest for each item.

4. Specifications for public contracts shall in all cases comply with the following requirements.

(a) They shall be clear, definite and complete, expressed with words used in their dictionary meaning and showing exactly what is required in the literal use of the words, which literal meaning must be used in carrying out the contract. If in any case questions arise in the execution of the contract that cannot be clearly answered by the specifications, the matter shall be adjusted by arbitration, in which the contractor shall select one arbiter, the official the second, and they two shall choose a third. Provided, the contractor or any citizen or corporation doing business in the state shall have the right to take the matter into the proper court.

The advertisement, instructions to bidders, specifications and contract form must together cover all necessary information to bidders. They must be concise. Unnecessary verbiage and repetitions must be omitted. Everything must be said once, clearly, and once only.

(b) They shall be itemized in full de-

tail, the unit of every kind of material entering into the structure appearing in the schedule of prices bid.

(c) No responsibility for contingencies shall be specifically put upon the contractor.

(d) The specifications shall be so worded and all arrangements and management concerning the bidding shall be such that all bidders shall be bidding upon fair terms for exactly the same structure or the same result, and upon terms of exact equality as to advantages or disadvantages in so far as the official calling for bids can control or embody it in the bid or award.

(e) The terms "discretion of the engineer," "judgment of the engineer" or their equivalents shall not appear in any specification or contract as calling for their exercise after the opening of bids, unless they be accompanied by full explanation in the specifications showing exactly how they will be exercised in the case any of the various contingencies with reference to which they are used shall occur.

(f) No requirement shall appear in the specifications that have a tendency to discourage bidding unless such requirement is manifestly essential to the work or to the public interest.

(g) There shall be no requirement in the specifications or in the management of the bidding that shall require any citizen to disclose the fact that he contemplates bidding or is interested in a coming bidding.

(h) Specifications must be so arranged that in comparing bids only one thing is to be taken into consideration, the total cost of the work.

(i) The specifications and drawing must all be ready for distribution and freely distributed as soon as the advertisement appears. No charge in excess of actual cost shall be demanded for any specifications or drawings accompanying them. They must be sold or furnished free to any one who asks for them without requiring any information from the party asking for them, and they must be returnable at cost after the opening.

(j) No specification shall require the contractor to follow the specifications and at the same time be responsible for accomplishing certain results, or to guarantee the endurance of the work, or to be responsible for the repairs for any time after the completion of the work according to the specifications.

(k) Specifications or instructions to bidders must suggest that every bid should be enclosed in two envelopes, the inner sealed with wax and the outer not showing that a bid is enclosed.

(l) The official estimate shall be printed in the specifications with the information that no award shall be made for an amount greater than the total of the estimates and no supplemental contract increasing the work beyond that limit will be legal. Also that no bid will be accepted in which the price bid on any article is more than 10 per cent. greater than the estimate, and that if in the execution of the contract it be necessary to increase the amount of any item more than 10 per cent. beyond the estimate, the price of such increase shall be determined by arbitration subject to court action, as specified in Sub. Par. (a) above.

5. Every citizen and every corporation doing business in the state shall have the full right to bid on any public contract and have the bid accepted if it is the lowest.

6. Bids shall be opened in public. All bids received must be kept and opened. Bids with erasures or changes in figures that affect the cost of the work must be thrown out. The public shall have the right to inspect the bids at the opening.

7. Whenever bids are advertised for they must be opened at the time mentioned, and an award must be made to the lowest bidder. Otherwise the lowest bidder shall have a legal claim for damages equal to the profits had the contract been executed.

8. Any citizen of the state and any corporation doing business in the state shall have the right of injunction in the proper court to require compliance with this law, and such citizen or corporation shall have the further right to appear as a party in interest in any suit or adjudication between the contractor and the city official whenever the matter of any public contract comes before the court.

9. In the execution of all contracts inspectors duly appointed according to law by the public official shall have full power to see that the specifications are literally carried out and the completion of the work or the delivery of the goods shall be followed by the proper certificate of the inspector that the work and materials have been in accordance with the specifications. This shall relieve the contractor of all further responsibility.

It is believed that few loopholes are left for the devious work of crooked contractors, although the perfection of the system proposed has not been completely tested.

The engineer who studies the provisions proposed and recognizes the conditions which they are expected to cover will see that practically every one of those complained of and to be superseded was originally an excellent provision devised for the purpose of secur-

ing good work, and he will find that he himself has been using many of them, and may still be using them successfully. But each one has been nullified in special cases by the manipulations of dishonest contractors, aided or permitted by dishonest or complaisant officials, until, in such cases as Major Gillette reports, they have become permanently vicious.

This is another instance of the impossibility of legislating men into honesty. Doubtless it will be more difficult for dishonest men to be successful in getting something for nothing under laws containing the provisions proposed, but will it be impossible? Will not the lack of flexibility of the new system more than offset the greater degree of safety?

The writer has found in his own experience that compulsory publicity in every step of the process of letting and carrying out a contract is the most efficient aid in keeping everything clean. And if this provision of publicity is supplemented by an independent investigating committee, which can check the accuracy of the statements made public, the objects sought are obtained quite as satisfactorily and without losing the benefits of the freedom which an honest administration should have.

We know better what specifications should be than we did thirty years ago, and there is even less reason for indefinite specifications now than then. Engineers are more competent and should not have the same opportunities to secure their educations at the expense of the public which they once had. Contracts can be drawn in better form and with more accuracy of statement and definiteness of detail. We should take advantage of all the advance which has been made in this line and which will yet be made. But this is more readily accomplished through the guidance of an expert commission which can give the municipalities of a state the benefit of the advances in the sciences than through the hard and fast provisions of a law which cannot possibly cover all the contingencies that may arise.

This is a most important subject, and Major Gillette's conclusions are presented with the hope that the readers of MUNICIPAL ENGINEERING may be able to add to the discussion which is now under way in the society for which the paper was written and will be carried on in these pages also.

THE QUESTION DEPARTMENT

Disposal of Single House Sewage—Sinking Well Through Sand.

What I desire to know is this: What would you recommend as being now the most desirable and practicable mode of disposing of the sewage from a toilet or bath room in a private residence? That is, would you recommend an open vault used as an outside water closet, a septic tank, or a cesspool? I have had advice from different parties here, and each seems to have a different idea of the matter. One says, to simply dig a hole in the ground, wall it up and let the sewage waste away by percolation; and another says to build a cesspool, like a cistern, and connect the same with a drain pipe leading from the cesspool to some low point or ditch.

If you have the desired information, I will consider it a great favor, if you will advise me, if not, if you can direct me to any person or company who can give the information, I will be greatly obliged.

Our city is now figuring on putting in a municipal water plant, but because of the fact that many of our citizens are skeptical as to the adequacy of our water supply, we are desirious of making a test by sinking a hole 6 or 8 feet in diameter; but the trouble we have run up against is, that when we get down about 30 feet, we strike a bed of sand or gravel from 5 to 6 feet in thickness, and the water at once rises almost to the surface of the ground. Now what we want to do is this; we want to go through this sand, and on down 20 or 30 feet, in order to make a reservoir below the sand, for the reason that other wells that have been sunk around here, and not through the sand, have always gone dry, because, as we believe, there was no reservoir created below the sand.

Now how are we going to get through this sand with twenty or more feet of water to contend with? Of course, we understand that we can make a wooden curb, which will sink down and follow the digging, thereby preventing the sand caving in, provided we can get rid of the water while digging. What would you recommend as the most practical method of accomplishing our purpose in a small place like this, where we have no kind of machinery at hand for disposing of the water?

A. H. F. Z., ———, Iowa.

The outside closet set over a vault or cesspool forms the common privy, which is almost certain to be more or less of a nuisance, and if the water into which wells are driven for private water supplies or for the public supply which is proposed is so near the surface, it will undoubtedly be polluted by the drainage through the earth from the cesspool. It is, therefore, very objectionable from the sanitary point of view.

The septic tank is a cesspool which is water tight and in which the sewage has an opportunity to disintegrate. The liquid in the tank will overflow when the tank is full and must be disposed of. A common way is to lead the overflowing water by a tile drain into porous soil in the garden, where the water which has been partly purified in the tank can seep into the soil near the surface, and be completely purified. The entrance of the house sewer into the tank should be through a pipe dipping below the surface and so baffled that it will disturb the liquid in the tank as little as possible. Many engineers think the garden irrigation is more successful if the overflow from the tank goes into a small chamber with an automatic siphon which discharges whenever the small chamber fills up. An installation similar to this is described in MUNICIPAL ENGINEERING, vol. xxiii, p. 35, and vol. xxxv, p. 244, in articles on methods of domestic sewage disposal. If there is a low point or ditch not too close to a house the effluent from the septic tank can flow into it as, ordinarily, it does not produce odor enough when discharged in this way to spread very far.

As to the water supply, the city will save money by paying for the advice of a competent engineer to come and study the local conditions and make recommendations.

Unless the water is very unusually large in quantity a centrifugal pump will keep it down in the well enough to get in the curb and permit the excavation. If a pump with a capacity of say 500 gallons a minute will not keep the water down the possibilities are that there is water enough for so small a city. Expert engineering advice should be obtained as to the possibility of contamination of the supply if it is sufficient. If a small pump can keep the water down in the test well, no artificial reservoir below the water stratum would have any effect in increasing the supply.

The fact that wells in the sand stratum have gone dry is evidence that it is insufficient as a source of water supply and that it will be necessary to find another water-bearing stratum farther down or at another place. The engineer suggested can test this readily and with reasonable rapidity.

Reference may be made to the "Business Directory," published in each number of MUNICIPAL ENGINEERING for names of competent engineers, under the heading "Civil Engineers," "Consulting Engineers."

Reinforced Concrete Floor.

I want to build a floor to warehouse, 70x100, of reinforced concrete. I would like for you to tell me the size rods and the distance apart and how many supports I would have to have. 28x70 feet on one end is to

store cement. Where can I buy the reinforcement for the floor?

W. L., ———, Mo.

The supports to the floor and the beams carrying the weight on the floor and its load to the support are quite as important as the floor itself. A proper design cannot be made without more information than is given. Designs for floors are furnished by the makers of the reinforcing material, if the necessary information is furnished. Makers of reinforcement are listed in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings "Concrete Reinforcing Bars," "Concrete Steel Arch Bridges."

Manufacturers Seeking Change in Location.

We are starting a new Board of Trade here and I am chairman of the Municipal Committee. Can you put us in touch with a magazine giving the names of firms seeking a change in location of business, etc.?

H. K. S., ———, Pa.

Can our readers give any information as to such magazine or a list of such names or individual instances of such firms?

Investment in Small Electric Lighting System.

Could you put me in touch with parties who have capital to invest in an electric lighting system for a small city of 1,500 population? The city may grant a franchise for a lighting system.

H. J. B., ———, Ill.

Can our readers make any suggestions of persons or firms interested in such an investment?

Cost of Macadam and Asphalt Paving.

Will you kindly give me the difference in cost of macadam roads and asphalt streets based on price per square yard.

G. S. N., Middletown, Pa.

Cost of paving varies so much with local conditions that it is not possible to give a definite answer to this question. In MUNICIPAL ENGINEERING, vol. xi., p. 217, will be found some information on the subject, showing variations in cost of macadam from 50 cents to $2.13 a square yard and in asphalt from $1.45 to $3.24, according to the local conditions. The means of these limits are somewhat higher than what may be termed the average costs, but the averages cannot be applied in any particular case, except in a very general way. The article referred to gives references to other articles which explain some of the reasons for the differences in cost.

Cleaning Catch Basins and Sewers by Pump.

We are looking up the matter of sludge removal from sewers and manholes and sediment from catch basins by the use of a small portable gasoline engine pumping outfit or otherwise.

C. H. E., Winnetka, Ill.

The writer knows of no articles upon this particular subject. With reference to cleaning sewers there are several articles in MUNICIPAL ENGINEERING. The more recent articles are the following:

In vol. xl: "An Interesting Test of a Sewer Cleaner," p. 69; "Flushing Street Sewers," p. 218; "The Kuhlman Patent Sewer Cleaning Machine," p. 294; "Sewage Ejectors," p. 300; "Methods and Tools for Sewer Cleaning," giving references to preceding articles on this subject, p. 345; "Official Report of a Test of the Sieben Sewer Cleaner," p. 376; "Commendation for Sieben Sewer Cleaner," p. 463; "The Sieben Sewer Cleaner in Cleveland," p. 538.

An article on "Dumping Catch Basin Refuse in Sewer," in vol. xxxix., p. 204, gives some valuable information.

Unless there is some special reason for taking the sediment out of the sewers before it reaches the outlet, it is ordinarily better to flush it out by means of water introduced under pressure from hose, using some mechanical device for loosening it if necessary.

Some of the sewer cleaning apparatus described in the articles referred to does this and one or two of the sewer cleaners lift the material dredged from the bottom to the street surface, where it must be loaded into wagons and carted away.

The deposits in catch basins and in sewers can not be removed by pumping unless they are stirred up, loosened and mixed with water enough for the pump to carry them. This means water to cart away as well as the deposits, so that it would seem to be less economical to remove such deposits by pumping than by dredging or by shovel, allowing the water to run off through the sewer. As described in one of the articles referred to, the catch basins can be cleaned partly if not wholly by turning water in through hose under hydrant pressure, and thus washing the deposits through into the sewer, but this increases the cost of cleaning sewers and the latter increase may more than offset the saving in removing the deposits from the catch basins by hand.

Our readers are invited to report their experiences in this matter.

Durability of Bitulithic Pavement.

Can you inform me what the average time a bitulithic street pavement lasts in the cities of the United States? How long do they usually last before repairs are necessary?

I. L. H., Baker, Ore.

This question can not be answered directly. Although bitulithic has now been used some ten years as a street pavement, its life has not yet been determined. To be sure there have been a few instances of early disintegration, but there are many pavements which do not give any evidence of material wear, although in use for several years. The amount and character of traffic is also an important factor in determining the life of the pavement. On residence streets where the traffic is light, repairs are seldom necessary, whereas on streets with

heavy traffic, especially if concentrated on particular lines by street car tracks or other special structures, frequent repairs will probably be necessary. In general it may be said that on streets not having the heaviest traffic a well-constructed bitulithic street has a longer life than its present age as a standard pavement, and that this fact also indicates that repairs will be light. Poor materials and construction and neglect and misuse of a pavement will all or any of them decrease the life of a pavement, make the time to first repair short and the repair bill thereafter large.

Books on Asphalt Paving.

Will you kindly give me a list of two or three of the best books, in your judgment, on asphalt paving? What I want more especially is a treatise on asphalt itself, its mixture and composition, and what constitutes a good or bad paving mixture, and why, not too technical in style. Permit me to congratulate you upon the excellent character of your magazine, which I read with much interest and find very helpful.

W. H. A., Bartlesville, Okla.

Reference may be made to MUNICIPAL ENGINEERING, vol. xxxviii, p. 269, for comment on books on asphalt construction including Richardson's "The Modern Asphalt Pavement" ($3); Peckham's "Solid Bitumens" ($5); Tillson's "Pavements and Paving Materials" ($5); Baker's "Roads and Pavements" ($5); Byrne's "Highway Construction" ($5).

Another book giving some excellent information is Hubbard's "Dust Prevention and Road Binders" ($3).

Size of Branch of Sanitary Sewer.

Will you kindly give me your opinion on the following situation? We will very soon begin construction on a piece of sanitary sewer, designed to become a head branch of a separate sanitary system. I have "Staley & Pierson" on the subject and working from their instruction I have specified for 6-inch pipe, which, of course, arouses the prejudice of old "rules of thumb" and wise heads that have put in pipes from infancy for surface and mixed drainage of all kinds, except sanitary and, of course, they know it ought to be anything from 10 to 18 inches or even 24 inches. It is against these and I understand the county surveyor is to be quoted against me, that I have to maintain and keep my credit with the council and your advice to an old reader will be very much appreciated.

The conditions are these: Total length, 1,300 feet; grade, 1 per cent.; patronage, 30 families with a future possibility not exceeding 100 families. Designed to be maintained as strictly separate system for final treatment in disposal plant.

I make out that 6 inches is ample and will carry the light flow better than a larger size and is more easily flushed if that becomes needful. If there are any practical reasons why 8 inches might be better I would be very glad to quote you to that effect.

C. E. V., ———, O.

A 6-inch pipe is ample to carry the sewage from the population you describe. Practically, however, it is found that an 8-inch pipe does not have as many stoppages as a 6-inch pipe when used for the same work. This is probably due to the fact that too large substances coming into the sewer from 4 to 6-inch branches are not as likely to lodge in an 8-inch sewer as in a 6-inch sewer. This practical consideration induces the engineer to make the 8-inch pipe a minimum for his sewer mains.

Delay of Contractor in Beginning Work.

Will you kindly advise me as to the proper procedure to follow in case a contractor refuses to commence work after having received a contract for street paving? The time limit has not expired at this writing, but it will be impossible for the contractor to finish the job within the specified time if he were to start at once. The city has the company's bond for the execution of the contract and, being anxious to have the work done, wants to know what action to take?

F. J. B., ——, Cal.

This is a question for an attorney familiar with California statutes and customs and with the terms of the contract. Generally speaking, it is difficult to start a contractor so long as he is keeping within the letter of his contract. In case you think he can not finish the work within the specified time if he begins at once, you may be making yourself trouble in collecting damages for failure to complete the work on time by trying to force him to do something which you think is impossible. If the contract has a clause assessing damages for failure to complete the contract on time at a given rate per day, the threat to enforce that provision seems to be about the only pord the city has.

Where to Obtain Standard Specifications.

Will you kindly inform me where I can obtain copies of the specifications for various classes of street paving adopted by the "Organization for the Standardization of Street Pavements?"

Also, will you give me the name and address of the Secretary of the "American Society of Civil Engineers?"

W. H. ASPINWALL, Bartlesville, Okla.

The Association for Standardizing Paving Specifications has recently issued its latest volume of proceedings, containing the standard paving specifications adopted, and the book can be obtained for $5 from the secretary, John B. Hittell. Engineer of Streets, City Hall, Chicago, Ill.

Charles Warren Hunt, 220 W. 57th St., is secretary of the American Society of Civil Engineers.

Right of City to Charge for Sewer Connections.

Can you give me the names of some cities, preferably in Texas, that make a monthly or yearly charge for sewer service? Can you refer me to any court decisions affirming or denying to a city the right to make such a charge.

I. B. D., City Engineer, ———, Tex.

Can our readers give us the names of such cities

It is quite common to make a flat charge for connection with sewer, and in some cases

the city is ultimately reimbursed for the total cost of the sewer by means of the collection of such fees. The right of the city to make such charges is affirmed by such decisions as that reported in MUNICIPAL ENGINEERING, vol. xl, p. 441, in the case of Harter v. Barkley et al., (Cal.) 112 P. R., 556.

There are several cities in the south, notably in Arkansas and Texas, which have private systems of sewers making charges of this sort. Their right to do so is apparently affirmed by a decision reported in MUNICIPAL ENGINEERING, vol. xxxix, p. 217, in the case of Pulaski Heights Sewerage Co. et al., v. Loughborough (Ark.) 129 S. W., 536, in which the right of the court to fix the charge in some cases is asserted.

A list of cities having sewers on the franchise plan is given in vol. xxxix, p. 40, and there is a list of articles on various phases of this subject in vol. xxxix, p. 35.

Methods of assessment for sewers are discussed in vol. xxxviii, pp. 190, 191 and 421, with numerous references to previous articles, some of which touch the subject of the question.

The articles on "Joint Sewer Connections" in vol. xxxi, p. 452, and vol. xx, p. 83, discuss the subject from still another point of view.

The right of the city or of the sewerage company to make a charge for connecting with the sewer being affirmed, the only question is as to the form of the charge, whether a sum payable on making the demand, payable in installments or payable as an indefinite annual rental. The three methods would seem to be similar in principle and equally subject to approval by the court unless there is some statute in opposition to one or more of them.

Who Has Control of Water Meter?

The Board of Water Commissioners of this village, believing that certain water meters were being tampered with, made a ru ing that all meters should be sealed, and proceeded to place a seal upon the meters. In some cases the meters are owned by the individuals using the water and in one of these cases, the individual broke the seal and contends that the Board has no right thus to assume jurisdiction over his property.

I believe that the Board of Water Commissioners have a right to enact any reasonable regulations for the control and supervision of the water system and that they were acting entirely in their rights in causing a seal to be put upon any and all meters through which municipal water passes, regard'ess of where the ownership of the meter may lie. I would thank you to send me an opinion and authorities upon the question if you have any.

E. S. W., Village Attorney,
———, N. Y.

The Water Commissioners certainly have control over the use of water and can make such regulations as will insure accuracy of reading of meters, provided such regulations do not interfere with the free legitimate use of water. The writer believes that the meters should be the property of the water plant, and not of the consumer, both because that is the logical ownership and because the control of the water and of its measurement can not then be questioned. But the fact that the consumer owns the meter does not abridge the right of the Water Commissioners to control the water nor to insure the accuracy of the measurement of its use, though it might in some cases restrict the choice of methods in which this control may be exercised.

Cases having more or less bearing upon the subject have been reported in MUNICIPAL ENGINEERING, as follows:

In vol. xi: Right to install meters affirmed, p. 527, Pond v. New Rochelle Water Co. (N. Y.) 127 N. Y. S., 582. Right to restrict use of water affirmed, p. 526, Kimbal v. Northeast Harbor Water Co. (Me.) 78 A. R., 865.

In vol. xxxix: Service must be without discrimination in kind or rates, p. 44, State ex rel. Ferguson v. Birmingham Waterworks Co. (Ala.) 51 S., 354. Meters at Company's Expense, p. 218, Wilson Water and Electric Co. v. City of Arkadelphia (Ark.) 129 S. W., 1094. Right to make regulations affirmed, p. 217, City of Mansfield v. Humphreys Mfg. Co. (Ohio) 92 N. E., 233. Discrimination is illegal, p. 125, People v. Albion Waterworks Co. (N. Y.) 121 N. Y., 660.

In vol. xxxvi, p. 186: Two decisions regarding regulations governing meters and who shall pay for them; one by the Wisconsin Railroad Commission that the plant must furnish meters, and one in the case of the State ex rel. Hallauer v. Gosnell, 116 Wis., 606, confirming some rather stringent regulations of meters and service pipes. An article on "Ownership of Water Meters," p. 178, gives references to many previous articles bearing directly on the subject of the question as well as on the subject covered by the title.

Books on Gas Construction.

A gas company has recently acquire l a franchise to build and operate a gas plant in this city.

Will you please refer me to a book or books that will give the engineering side of the gas business in regard to the placing of mains in the streets, of gas plumbing, of the damage done to pavement by gas, of the laws and regulations of the gas business, etc.

I have charge of the placing of the mains and the city's side of the supervision and I wish something that will give me a working knowledge.

G., City Engineer, ———, Ore.

The following books should be of interest in studying the problems of gas distribution most of them being English:

Hole's "The Distribution of Gas" ($7.50); "Self Instruction for Students in Gas Manufacture," a catechism in several volumes, two being on distribution, one elementary and one advanced ($1.75 each); Latta's "Handbook of American Gas Engineering Practice" ($4.50); Hughes's "Construction of Gas Works" ($4); Gerhard's "Gas Piping and Gas Fitting in Buildings," American practice ($3); Hughes and Gray's "Practical Gas Fitting," American ($1).

The following articles in MUNICIPAL ENGINEERING will also be found valuable:

In vol. xl: Legal decision that gas company must prevent leakage, p. 526; "Sufficiency of Proposed Gas Franchise," p. 511; "Gas Processes and Rates," p. 38.

In vol. xxxix: "Information About Gas Masufacture," p. 389; "The Regulation of the Amount of Sulphur in Gas," p. 156.

Title to Recorded Reservations for Parks.

This borough is thirteen years of age, and when the East Side Land Company laid out the town it incorporated in its plan two parks, but in recording it reserved the parks so called. In all the advertisements, representations and maps it set forth the parks, and in deeds it made reference, in describing the lots as abutting or contiguous to the parks. It never made any claim on the parks, never paid taxes on the same, but left them entirely with the borough to use, take care of and protect.

What right of ownership does it have? By what authority can it step forward and make a deed to others for the parks?

The parks are practically worthless, being gullies. I would appreciate your opinion.

D. R., Burgess, ———, Pa.

This seems from the brief statement given to be one of those indefinite cases, the decision of which depends upon so many items of reservation, deed, record, claim, occupation, etc., that the rights of the borough in the parks can be determined definitely only after a hearing at which all the evidence can be brought together. It would seem that the parks must continue as parks, whether belonging to the borough or to the land company, and any one affected by their use for other purposes could enjoin such use or collect damages for breach of contract or trespass upon his rights, and possibly could enjoin transfer of title to any one except the municipality.

It is presumed that "the parks are practically worthless" for other purposes than their use as parks, for "gullies" can often be made very valuable for park purposes. If the former is true it should be possible to prevent the use of the ground for other purposes and then to secure at least tacit permission for the borough to assume control, even if the reservation of the park land is not sufficient authority for the assumption by the borough of ownership within the limitations of the reservation.

The laws of the State of Pennsylvania may or may not cover the case. The borough's attorney should be able to give information on this point as well as definite advice directly applicable to the case, which one outside the borough and state must discuss upon general principles only.

Drainage for Flat Streets.

We notice from time to time in your journal, questions answered which must be a great help to the questioner. We have a seashore town which has not very much fall from the ocean side to the bay and we are bothered with surface drainage. Originally this did not make so much difference because our streets were not thickly graveled, but now that they are graveled from curb to curb the water does not soak away, and we want to get some scheme of conducting it under our cross streets so that it will find its level to the bayside.

The town is about two and one-half squares wide and twenty squares long. We have about 5 feet fall in the two squares and a half to the meadow edge. I do not know of any inlet or sand trap that will be quite satisfactory to our purpose.

If, through your paper, you can give us any information about this, I shall greatly appreciate it.

R. F. ENGLE, Beach Haven, N. J.

I would be pleased with your suggestions and comment on the following proposition:

Given a system of paving with bitulithic having flat grades (0.4 per cent.) and level intersections; also there being no outlet for storm sewers without going a prohibitive distance. I should like a suggestion on carrying storm water across intersections by inlet and pipe culvert and particularly on the manner of outlet into the gutter again on the low side.

On several intersections it will require two 12-inch pipes and placing same level and just beneath the concrete foundation the inverts will be 1.67 feet below gutter at both the outlet and inlet; and since the grade to the next intersection is only 0.4 per cent. there is no chance to depress the gutter. Consequently the drain will remain full of water after each rain.

I do not find any catalogued casting with grating which might be used at the outlets, my idea being to have a removable grating set at an angle of 60 per cent.

I would be pleased to have suggestions on changes or substitutes.

What is the editor's opinion on carrying storm water over bitulithic pavement on the surface at intersections? I notice this done in some instances in several cities.

B. L. B., City Engineer, ———, Okla.

With reference to the first question the writer would suggest the propriety of short drains on the cross streets, starting from the corner of the highest longitudinal street and running to the "meadow edge." Each drain should start as near the surface as possible and be given the full fall to the water's edge. Inlets should be made at each curb corner passed by the drain to which water runs. The longitudinal streets should be graded so that the water will run to one end of each block or from the center of each block to the two ends. The depth of this drain may not be sufficient to lay it in the center of the street and allow connections to be made from the curb corners. In such case a drain must be laid under each gutter. This plan should take care of the street drainage completely.

A similar treatment would be necessary to take proper care of the drainage of the streets in the second case, except that the greater distance would probably permit the collection of the water into a single outlet sewer or drain. Anything short of this will be but a partial solution of the problem and, therefore, more or less unsatisfactory.

If it is necessary to carry the water over the surface wholly, the pavement, gravel or bitulithic on the streets which the water must cross, can be so graded and laid as to make a wide channel for the water to flow in, the bottom of which will be low enough

to take the water from the gutter of the cross street on the higher side and carry it across and deliver it to the gutter on the lower side. Unless the spread of water over a considerable area during rains is objectionable, the slope to the bottom of this channel along the street which is crossed by the water may be slight and the obstruction to traffic may thus be made a minimum.

If such open channels in the street can not be used, closed channels or culverts may be used. In the cases of both correspondents these culverts will be very shallow, since the bottoms must not drop below the gutters on the lower side of the street crossed by the water. It will, therefore, be necessary to make them wide and to cover them by substantial slabs, forming bridges across them or culvert tops. These slabs must be raised high enough to insure no obstruction to the flow of water and will produce some obstruction to travel near the gutters, and may even require some elevation of the center of the street. If carefully designed the street intersections will not be serious obstructions to traffic, however. The culverts below the levels of the gutters suggested by the second correspondent will be very unsatisfactory for, even with a street paved with bitulithic, more or less sand will deposit in them and they will be obstructed and must be cleaned out. If used, covered catch basins at upper and lower ends and provision for easy access to the whole length of the culvert must be provided. The bridges referred to will be expensive to maintain, but will be more satisfactory than the culverts below grade.

Have our readers anything to suggest for either case?

Breaking Grades of Streets on Hills.

We are at the present time paving some fifteen miles of our sidewalks with concrete paving and are at the same time curbing and grading the streets.

The streets running one way have extreme grades varying from 3 per cent. to 6 per cent, and the corresponding cross streets have much flatter grades and are in some cases very flat grades. The streets are 24 feet wide between curbs and are of a sandy clay soil, very easily washed. The streets are crowned about 10 inches.

The point in question is this: I am running the grades on the streets having the greatest fall between centers of the intersecting streets, and as the corners of a cross street are approached I break the grade 20 feet distant from the corner of the cross street and bring it up or down to meet the curb grade of the cross street. The curb elevations on all of the streets are kept level on points at right angles to the center line of the street. By doing this I keep the opposite sides of the streets level and the intersection corners practically level. This makes each street have a slightly greater grade from a point about 20 feet from each intersection corner, and the increase or decrease in grade is appreciable to the eye. If I start the grades of the streets having the greatest fall from the opposite corners of the cross streets and so break the grade for each square, I give the street the appearance of coming to a peak at each intersection. If I attempt to to make one corner lower than the other, I necessarily will have to make one curb grade on the cross street of a greater elevation than the other curb, and as the streets are only 24 feet between curb lines, this is, in my opinion, very undesirable and is only permissible in cases where it cannot be prevented.

Let me have your decision as to the best method in getting the grade at the corners of the cross streets and in running the grades on the streets having the greatest fall.

G. E. H., City Engineer,
———, Ala.

Not all the information desired is given. Assuming blocks 300 feet long, or 324 feet between centers of streets and 5 per cent. grade between these two points; if the grade is broken 20 feet from the curb, as suggested, the grade from this point to the curb line will be 8 per cent. at each end of the block. This is not so objectionable at the upper end of the block, unless there is a smooth, slippery pavement. Careful grading and maintenance will be required at the lower end of the block to prevent undue wash of storm water drainage to the gutters if not perfect. If the grade is run between curb lines then the fall will be 16.2 feet in 300 or 5.4 per cent., and the profile of the street will show alternate level stretches at street intersections 24 feet long and gradients of 5.4 per cent. each the length of the block between curbs of the intersecting streets. This would seem to be preferable to the scheme proposed, both because it is more simple and because it does not have the rather excessive 8 per cent. gradients.

In the case described by our correspondent the easiest way to set out the construction profile is to run the line between centers of streets, setting stake at curb line showing the elevation, which will be, as derived from the above, 0.8 foot above the straight grade line at the upper end of the block and 0.8 foot below at the lower end; set another stake 20 feet from the curb line of the intersecting street to show the break of grade at the point where the steep 8 per cent. grade meets the regular 5 per cent. grade line.

In the case described by the writer, set the curb stakes at the same elevation as the center of the street, this center elevation being the same as that fixed for the other method. Then run the grade line straight between lower curb line of upper cross street to upper curb line of lower cross street, at the per cent. fall necessary (5.4 in the case assumed).

The same procedure would be followed for other lengths of block, widths of streets and differences of elevation.

With 24-foot streets the curbs should be kept as nearly at the same elevation as possible.

It seems to the writer that his suggested plan will produce less appearance of "peak" than the one proposed by our correspondent.

What have our readers to suggest?

This subject has been discussed at considerable length in MUNICIPAL ENGINEERING at various times. In vol. xxxvii, pp. 181 and

256, and elsewhere in the same numbers (September and October, 1909,) will be found some information and also lists of previous articles and of books treating the subject from various points of view.

How to Compute Excavation for Grading Street.

Can you please tell me through your question department how the depth of a cut on a grade of a paving job can be ascertained?

For instance, as an example, a proposed work of 12,000 surface yards of pavement, the engineer giving 6,000 cu. yds. as an estimated quantity of grading. And knowing the amount of surface yards on a piece of work, where as yet the engineer has not an estimate of the amount of excavating to be done, after sizing up the work and coming to the conclusion that there is about an 8-inch cut, what formula do you suggest to find out the quantity of dirt to be taken out?

E. W. H., ———, Wis.

This question is too indefinite for satisfactory answer.

The average cut in the first example would be obtained by dividing the number of cubic yards of grading, 6,000, by the number of square yards of pavement, 12,000, the quotient being the average cut, 0.5 yard or 1.5 feet.

If the excavation in the second example is uniformly 8 inches the cubic yards of excavation would be obtained by multiplying the area of the pavement in square yards by 2/9, which is the 8-inch thickness expressed in yards.

These results are probably very rough approximations, unless the excavation is in a street already graded very nearly to the same form as the new grade and so must be checked by more careful measurements if the grading is a large part of the contract.

Reduction in Cost of Asphalt Paving in Milwaukee.

To the Editor of MUNICIPAL ENGINEERING:

Sir—There have been some developments in the matter of street paving in this city during the psat year which, we think, will very much interest your readers.

The average price for the first six months of 1910 for asphalt pavement was $2.39 per square yard.

Prior to 1910 the average price was usually considerably above this figure. We made certain changes in the specifications along lines of economy, always with the best possible expert advice, the binder course and brick gutters being eliminated, and other slight alterations made. This reduced the average price for the second six months of 1910 to $2.07 per square yard, a saving of 32 cents on each yard laid.

Since the very beginning Milwaukee asphalt pavements have been laid under "closed" specifications that created an absolute monopoly for the local political contracting ring. This spring we opened up these specifications along the line of the report of the Association of City Officials for Standardizing Paving Specifications, making a few changes in same under the advice of Mr. Lester Kirschbraun, director of the Chicago Paving Laboratory. Following the recommendations of the said Association of City Officials for Standardizing Paving Specifications, we also eliminated the five-year guarantee, substituting in its place provisions for the strictest inspection.

As a result of these new arrangements the price of asphalt pavement, including grading, 6-inch concrete foundation and 2-inch stone mixture sheet asphalt wearing surface, has taken a very decided drop of 65 cents per square yard. On Wednesday, May 24, we let three contracts aggregating 60,000 square yards, the prices on which were $1.40, $1.41 and $1.45 per square yard, respectively, averaging $1.42 per square yard. About 5 cents of this drop in price may be charged to a saving by eliminating the five-year guarantee and a few slight changes in the specifications made at this time; the other 60 cents reduction in price can be charged to nothing save the "graft" which existed under the old "closed" specifications that created a "monopoly" for the two local "political contracting" asphalt paving companies.

In other words, the price of asphalt paving has dropped about $1.00 within one year, not more than 40 cents of which reduction may be charged to economy, and the other 60 cents or more per square yard can only be accounted for as plain, ordinary "graft" under "closed" monopoly creating specifications. Milwaukee has approximately 1,000,000 square yards of this class of paving, which means that she has been mulcted in the past of just about $1,000,000 on this score alone.

C. A. MULLEN,
Supt. of Street Construction.
Milwaukee, Wis.

Who Supplies Chloride of Lime for Sewage Treatment?

Kindly give me the name and address of firm that handles chloride of lime in bulk for use for sewage treatment.

C. E., Oklahoma.

The following firms supply calcium chloride: Marblehead Lime Co., Masonic Temple, Chicago; Carbondale Calcium Co., Carbndale, Pa.; Cochrane Chemical Co., 55 Kilby street, Boston; Solvay Process Co., Syracuse and Detroit. Some Eastern firms are named in MUNICIPAL ENGINEERING, vol. xl, p. 41.

Amount of Jute in Sewer Joints.

Can you tell, approximately, the number of pounds of jute or oakum required for gaskets for, say 2,000 feet of 8-inch sewer, vitrified pipe?

J. A. W., Lexington, Mo.

This length of 8-inch sewer may use about 100 pounds of jute. The exact amount will depend on the specification and the style of joint used.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of composition, the fact is what is wanted. Use the Question Department for what you want to know. use this Department for what you can tell others.

Transverse Expansion Joint in Brick Road.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Enclosed herewith find a clipping from the *Conneaut News-Herald* of June 3. The pavement in question is a country road running from the city limits to the Pennsylvania state line. The writer, after reading this article, made it a point to inspect the pavement and found it exactly as stated in the county surveyor's article.

The pavement is in excellent condition, and we must admit that they got a very good application of the cement filler on this work. The pavement has been laid now for three years and shows no wear whatever, although it is the main road between the east and the west, and the traffic through from Cleveland to Buffalo and intermediate points passes over this road.

F. B. DUNN, Conneaut, O.

The clipping referred to reads as follows:

LETTER FROM J. S. MATSON, COUNTY ENGINEER.

In your issue of Monday, May 29, 1911, you refer to an explosion in the brick pavement on the East Conneaut road. You also state that this explosion was caused by the lack of expansion joints across the pavement. I would like to call your attention to a few facts in regard to this matter and the reasons that caused us to omit transverse expansion joints in this pavement.

We provided for expansion joints at the curbs and at the street car track. As an experiment, one transverse expansion joint was put in, extending from the street car track to the north curb. At this said joint the explosion occurred.

The pavement on the south side of the street car track, having no transverse joints, and subjected to the same amount of heat as the pavement on the north side of the car track, with one joint, remained sound. What would be the reasonable conclusion? At the time the specifications were drawn for this pavement we gave a great deal of consideration to this question. As the result of our investigation we found that the city of Cleveland did not use transverse expansion joints and did not believe in them. Neither did Cuyahoga county. The fact that neither Cleveland nor Cuyahoga county made use of these transverse expansion joints seemed conclusive evidence that their use was unwise, as the city of Cleveland and Cuyahoga county are known the country over as having a greater proportion of perfect brick streets and roadways than any other locality in the world.

Further investigation confirmed this conclusion. Mr. W. P. Blair, secretary of the National Paving Brick Manufacturers' Association, presented a great mass of evidence upon the subject and stated that the National Paving Brick Manufacturers' Association in its campaign for proper construction of brick pavements was absolutely opposed to transverse joints.

At the time this pavement was laid we came to the conclusion that the only wise course was not to use transverse expansion joints. It is my opinion today that such a course was proper. The explosion in this road instead of changing this opinion has strengthened it.

I would be most happy to go into this matter more fully with you, as I appreciate that you do not desire to advocate a course that would be against the public good.

J. S. MATSON, County Engineer.

W. P. BLAIR'S OPINION.

I may say that the foregoing is the consensus of opinion of the experienced engineers of the country upon this subject—that contraction and expansion follow the course of least resistance, and no one realizes more than engineers the power of this force, and when started in one direction it is tremendous.

There are some influences that control this force and its direction that engineers themselves do not understand fully, and yet no private engineer has either the means or the time at his command to solve some of these problems by research work.

Just this very thing is considered so important, however, that the United States government, through its Bureau of Standards, has brought into use the most delicate measuring instruments for the purpose of measuring these expansion forces. They have already put their pins in the celebrated Indianapolis Motor Speedway for this purpose. This speedway is constructed in the most approved manner, and I may say like methods were followed in the construction of the Conneaut road. Investigations of this character will be followed by the government in July, on the streets and highways of Cleveland and Cuyahoga county. Thus we may understand that these are not ordinary questions, but involve problems of the highest and yet minutest of scientific investigation.

Mixing Concrete for Street Paving.

To the Editor of MUNICIPAL ENGINEERING:

Sir—To mix and place concrete economically for street foundations it is necessary to have a specially designed mixer. The object is to handle materials with as few hand operations as possible. The machine must not be too expensive in first cost or operation. To get the most benefit from the cement used a batch mixer is necessary, and is specified by city engineers who want the best results.

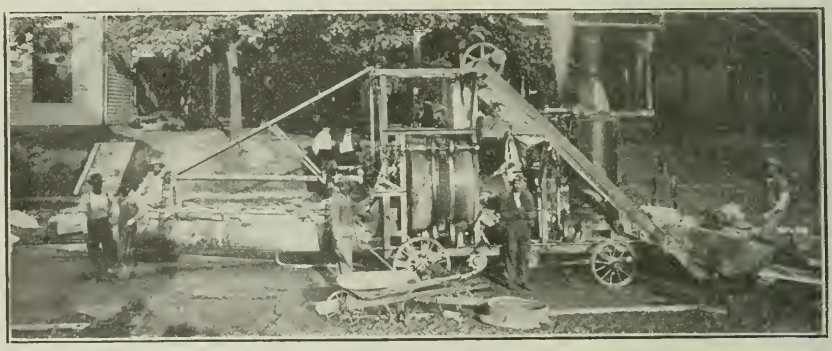
We have used for one season a Chicago street paving mixer which has a distributing drum on discharge end. It has laid about 20,000 street yards of 6-inch concrete during the last season without need of repairs. The same is equipped with an 8-h.p. engine and 10-h.p. boiler and the regular No. 14 Chicago mixer drum and automatic water tank, all of which are mounted in a heavy truck, the wheels of which have wide tread to protect the subgrade.

On each side of the boiler is a runway for the charging skips. There are two charging skips, each holding more than half the entire batch, which enables the charge to be loaded twice as fast as if only one skip were used, and also gives even keel to the machine. While the skips are up discharging into the mixer drum, the wheelers load their barrows and are ready to load skips as soon as they are lowered, thus working steadily and gaining time.

The skips empty into chute to mixer drum. The water is applied to the same for each batch from the automatic water tank, and as the mixing is very rapid the batch is discharged to the distributing drum after about one-half turn of the mixing drum.

The distributing drum is 18 inches in diameter and 15 feet 9 inches long and has blades riveted spirally on the inside. The same is supported by two roller chains from a gantry and swings in an arc of 180 degrees. One chain is an idler, but the other drives the drum at slow speed through the chain of gears from engine shaft. The spiral blades continue the mixing operation and also pass the concrete rapidly to the distributing end, where it is deposited where desired, by swinging the drum from side to side. Thus the material is handled by the machine from skip to final location in the street foundation. The concrete is run through wet enough so that when leveling and smoothing with shovels the grout comes to the surface, this being considered the best consistency for good concrete.

As the work progresses the machine is moved forward with its own traction and thus is a self-contained plant. It saves all wheeling of mixed concrete, and when the unmixed material is distributed carefully this wheel may be also kept down to the minimum. The use of wheelbarrows has been successful on the charging end for the reason that the men are loading barrows while skips are up. This saves time, as a barrow dumps into the skip practically as quick as a man can throw a scoopful, and the difference in quantity is immediately seen to be a saving in time. Also where an occasional longer wheel comes on account of scarce quantity of material, there is no delay.



CONCRETE MIXER FOR LAYING PAVEMENT FOUNDATIONS.

This machine laid the 6-inch concrete base in New Jersey street a total of 6,400 street yards. The total labor cost, including all delays, man in charge receiving material before work started, coal, etc., averaged 4⅞ cents per yard. We used 12 men as follows:

One foreman, per day	$5.00
One engineer, per day	5.00
Two men, smoothing and leveling concrete, each, per day	2.00
One man, discharging from mixer, per day	2.00
One man, cement, per day	2.00
Five men, loading skips, each per day	2.00
One man, cleaning grade, per day	2.00

With these men, as above, it was easy to maintain an average of 1,000 yards per day of ten hours. Many days as much as 1,200 yards were laid, proving the assertion that it is only the ability to get material into the

charging skips that governs the capacity of the machine. For instance, one day, or rather part of a day, 780 yards were laid in six hours, or at the rate of 1,300 yards in ten hours.

On the average basis of 1,000 yards per ten hours with the men as stated, the labor amounts to $30.00, to which add $2.00 for coal and oil, gives a total of $32.00, or at the rate of 3.2 cents per yard. After using this machine for one season we are highly pleased with the same.

THE MARION COUNTY CONSTRUCTION CO.,
BY W. L. SMITH, Indianapolis, Ind.

Bituminous and Cement Fillers for Brick Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Please make the following corrections to the descriptions of pictures in my letter about "Bituminous and Cement Fillers for Brick Pavements," which appeared in the June number of MUNICIPAL ENGINEERING, beginning on page 517. On page 519 photograph No. 4 is cement filled instead of pitch filled, and the same applies to photograph No. 5, on page 520. Otherwise I was very much pleased with the article.

F. B. DUNN, Conneaut, O.

Country Roads, Their Care and Repair.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The one essential in road repair and maintenance is to cure the bad spots in same. The fault with most past attempts at country road fixing has been that they have tried to and have fixed up parts of the road that did not need fixing. A very large proportion of them are only bad in spots, and as a rule these spots are few and far between; but a road (like a chain which is only as strong as its weakest link) is only as good a burden bearer as the worst place in it to pass through. When you stick in one of them you have exceeded in your load the limit of that road. Now, instead of curing these bad spots, yes, even to picking out the worst of them to cure first, the rule is to mark off a certain section of roadway and decree so much covering for this whole section with either crushed stone or gravel, and when they have spread this they will still find they have the depressions, as the covering will not compress on the hard parts of the road as it will in the soft places, and so they have not cured the water pockets, nor the bad spots in the road. I wish to emphasize the necessity of first curing these soft spots, as once they will carry a load, it will not be found necessary to do much of anything more on the rest of the road to make it carry its load.

My critics will probably say we have been filling these places for ages with the one result; but my reply is that you have not been giving them a scientific filling, or used methods that would promise lasting results. The proper method in using untreated material is to fill to a good crown, and be careful not to slop over. The filling should be wet, so as to pack as firmly as possible. It will not need a great deal of tamping, as the traffic over it, with a little nursing, will pack it more firmly than would be possible from any other method. This nursing constitutes one of the scientific methods of road repair, and by nursing I mean the pushing back of the filling that has been crowded out by the traffic, especially after a rain. At this time it will be well to have a cart load of filling material along, and if the filling has been so packed or removed as to leave a depression, fill in again to a crown, thus eliminating the water pocket. Care should be taken in these fillings not to spread over onto the hard road surface surrounding these holes, as in that case you are likely to still have a pocket, in fact, will have both a hill and a hollow, and an imperfect patch.

The drawback and unsatisfactory experience one has with the untreated roadway is its rapid drying out, loosening and shifting tendencies. This is overcome by the use of the calcium chloride road mixture, which gives ten times the moisture bond and damp packed condition to your road patch that is possible from a natural, untreated surface, and one ton of this chemical, costing $13, will fix up a car load of gravel, costing from $25 to $40, and a car load of this mixture will go a long way in filling dangerous or load-sticking holes in the ordinary country road. With this mixture the nursing spoken of above is equally essential, and you will get ten times the service, and very much more satisfactory results than with the untreated surface; but in either case the little care needed to keep the patch in place and fully up to its duty will be found a well-paying expenditure of time and effort.

The chemical used in this combination is virtually a chemical sponge, having ten times the absorption and evaporating properties of any other known substance. It is this moisture-absorbing and retaining feature that makes a patch made of the combination so lasting and satisfactory. The bond of moisture also given the lower strata of the patch insures its packing and staying in place under very trying usage. In fact, generally speaking, the harder the usage, the more solid it becomes. This lower reservoir of moisture also, besides tending to hold this lower body in bond, gives a reserved supply of moisture to the top surface layer, and so tends to longer hold it in place. In excessive and long-continued drouths the top layer would be likely to loosen and shift a little; but the first rain would tie it down again as firm as ever; or if convenient to give it a light sprinkle once or twice a week you would be assured of perfect conditions at all times.

Now, as stated in another part of this article, I do not believe it is necessary or

desirable as a rule to cover the entire surface of most of our country roads with a foreign substance. It may take some time, possibly two or three seasons, to find and cure all the bad spots in a roadway; but once you have found and cured them, you will find the cost has been but a trifle of what a whole resurfacing would have been, and you will have a roadway that you can maintain at a fraction the cost of the built-up roadway. There is one thing here that it might be desirable to do; that is to give the unfilled part of the roadway a treatment to lay the dust. This would consist of scraping and leveling the whole road surface so as to get a runaway for the surplus water, as this chemical after absorbing its fill (and this will not develop into mud) will take no more, so all surplusage should be allowed to drain off and run away. Then scratch this leveled road surface lightly with a fine-toothed harrow or rake and scatter broadcast about 1½ pounds of chemical to the square yard, and after a couple of hours work it in with a rake or harrow. This spreading of the chemical can be done with some of the mechanical seed sowers, notably the Buckeye, or by hand with a shovel or tin scoop. It is only a question of getting it spread as evenly as possible, so that it will give an even distribution of the moisture, and to have it protected from a too free action of the sun and wind, and so keep it from drying out too fast. This will give a compact and dustless surface, and a pleasanter one to ride or drive over, than you will get from any of the built-up roads. And one that will cost far less to keep up and in good repair than any known made road.

To insure the smallest possible chance of rutting you should give the road as good a drainage as possible. This is easily attainable in a majority of cases, and would have to be provided in every case where any form of built-up roadway was put in, generally in a much more expensive form than will answer on a common dirt road. It is possible that to find and cure all the soft spots in a roadway would require, as stated above, two to three years; but with drainage such as I have suggested, once the bad spots were filled they would have very little further trouble with the road, and I think in only a few cases would it be found necessary or desirable to top the road with either stone or gravel.

Everyone knows that all the dust accretions that are blown from the road surface are a waste of road material, and all close observers of growing vegetation are aware that nothing is more detrimental to it than a thick coat of dust and a light wetting, such as the bulk of our light showers give, so that it is desirable to hold this dust in bondage wherever possible, and the chemical treatment will do that perfectly. The cost is trifling, when the saving to the road is considered, together with protection to the shrub, flower, plant and tree life, so that little excuse can be given for maintaining impassable roads.

S. G. Howe, Detroit, Mich.

Concrete Foundation Under Steam Railway Track.

To the Editor of Municipal Engineering:

Sir—In your April issue, page 351, you request information about concrete foundation under steam railroad tracks.

Until March 1 I was on the engineering corps of the E. & T. H. Railway Co., and during this last winter superintended the construction of a concrete foundation, ballasting, curbing, relaying with 85-lb. rail and new ties of the union or transfer track between the E. & T. H. and L. & N. railroads in Evansville. This track lies in a brick street, and as all of the Chicago-Florida and Chicago-New Orleans traffic, both freight and passenger, goes over this track (all that part of the traffic that goes through Evansville over these two roads), it was necessary to provide a very substantial foundation, because there are some very heavy trains to cross it.

The work was started December 1 and completed March 1, which also makes it interesting. J. G. B., ———, Ind.

Central Electric Station Power Rates and Economy.

To the Editor of Municipal Engineering:

Sir—From the public's point of view the method fixing the proper price of electricity is usually a mystery. The various forms of sliding scales of price and discounts used by the electric lighting companies arise from the practical impossibility of cheaply storing electric energy. Since the consumer usually has the right to call upon the electric light company at any time for the maximum amount of electric energy required by his installation of lamps or machinery, the electric light department must prepare to meet his demand by installing an equal amount of generating machinery, although it is quite possible that the consumer may have use for his maximum demand only once in a year, or never at all.

The rate question has been one of the most widely discussed topics to date, both among and outside of those engaged in the operation of electric public service installations. In the majority of cities and towns the rates for electric light and power service have been made without a study of the costs to the producer, or manufacturer, and user, of the motors in the various manufacturing establishments and industries; or a study of the ways and means to reduce the cost of operation to the consumer and still receive as high a rate for the energy furnished as is consistent with the continuous and satisfactory service, thereby securing maximum return to the elec-

tric department with a minimum investment in plant, copper and distribution equipment, at the same time reducing the cost of energy to the consumer and allowing him a greater margin in the manufactured article.

The effect on the central station and consumer will be surprising if the motor service is given a fair trial. Beginning at the station, it will be found a fact that most engines operating at or about one-quarter load will require from 60 per cent. to 70 per cent. of the steam required to operate at full load. Now, what does this mean to the operating costs In the first place, there is only a very small increase in operating expenses, such as oil, waste and maintenance, no additional expense for labor, and almost none for fuel up to a point very near full load for a motor load operating between the hours of 6 a. m. and 5 p. m., equal to the peak load at night.

These facts also bring up the question of the type of motor to be most suitable for the department and the question of rating; the effect of the price of the motor on both the business prospects of the department and that of the prospective customer.

The most efficient motor will probably be the highest in first cost, and the purchaser may object to the cost when comparing the prices with some other make and type of motor. Where does this affect him as compared with the department In any case there is only a slight difference in the price, which the purchaser pays but once if the most efficient motor is purchased, but which is paid for many times by both the department and the purchaser if the cheaper and less efficient motor is purchased by the consumer to save slightly in first cost. The purchase of a motor of low efficiency requires the department to make a larger outlay in both line and equipment, with the subsequent losses and the inevitable result is that the department is compelled to charge more for the service than it would have to do with the more efficient unit; the purchaser pays more for his service, both because his unit consumes more energy and because it costs the department more to manufacture the energy.

The question of the maximum return per kilowatt in plant, copper and transformers will, or should, determine the type of motor to be used, as the effect of the motors on the regulation will be found practically nil as compared to what will be found in a large number of stations if the proper transformers and generators are installed for inductive loads, with a carefully arranged motor installation. This is especially true of the transformers. The regulation is also affected by the size of the motors and the load they carry to a very great extent.

The control of the size is the next question. The rates for motor service should be so worked out that a motor only large enough to do the average work required, even if overloaded occasionally, would be installed, for why should the department install equipment lines and transformers for a customer who thinks he may install some machinery additionally at some future period which also depends on the growth of his business and may require 25 per cent. to 75 per cent. more outlay?

The effect of this on the department is that the motor is about half-loaded, probably less, the power factor is low, resulting in reduced capacity of feeders for others, heats the transformers and requires more equipment at the plant, and does not permit of the operation of the engines at the maximum efficiency.

The rate is so made that the smaller the motor installed and the nearer to full load that it is operated, and the longer the hours it is operated the lower the rate. This statement applies to all consumers, large and small, though there will be a slight increase to the small consumer, due to the fact that a small installation costs more per kilowatt and the losses are greater. It costs as much to read meters, bill and collect for the small consumer as it does for the large, although the kilowatt hours consumed will be very much less. The rate favors the long-hour consumer and induces him to lay out his plant so as to reduce to a minimum the cost of shafting and hangers in use that do not produce a revenue, grouping his machines for proper routing of material, and keeping those machines together that are used more continuously. This arrangement, together with accessibility, will result in greater output for the customer and secure a high power factor with consequent reduction in the size of transformers and meters installed.

WILLIAM PLATTNER,
Manager Municipal Electric Light Department, North Attleborough, Mass.

Following is the schedule of rates used by the department:

—Power Rates—

Voted—To allow a discount of ten (10) per cent. on commercial lighting sold after June 1, provided the bill is paid on or before the 16th day of the month following the month in which the current is consumed. No discount allowed on minimum charge.

Voted—To allow a discount of ten (10) per cent. on power current sold after June 1, provided the bill is paid on or before the 16th day of the month following the month in which the current is consumed. No discount allowed on minimum charge.

NORTH ATTLEBOROUGH ELECTRIC LIGHT DEPARTMENT.

CONTINUOUS RATE—POWER RATES.

H. P. Demand.	Rate per Demand.	Kilowatt Equivalent.	Rate per Kilowatt Hour.	Current Charge.	Total Monthly Charge.	Discount.	Net Monthly Charge.	10 per Cent. 16 Days.	Net per Kilowatt Hour.	Rate H. P. per Year.
1	2.00	176	.0275	4.84	6.84	..	6.84	6.16	.035	73.92
2	4.00	352	.0275	9.68	13.68	..	13.68	12.32	.035	73.92
3	6.00	528	.0275	14.52	20.52	..	20.52	18.47	.035	73.92
4	8.00	704	.0275	19.36	27.36	..	27.36	24.63	.035	73.92
5	10.00	880	.0275	24.20	34.20	2	33.52	30.17	.0342	72.52
6	12.00	1056	.0275	29.04	41.04	4	39.40	35.46	.0335	70.77
7	14.00	1232	.0275	33.88	47.88	6	45.01	40.51	.0328	69.44
8	16.00	1408	.0275	38.72	54.72	8	50.34	45.31	.0321	67.96
9	18.00	1584	.0275	43.56	61.56	10	55.40	49.86	.0314	66.48
10	20.00	1760	.0275	48.40	68.40	12	60.19	54.18	.0307	65.01
15	30.00	2640	.0275	72.60	102.60	15	87.21	78.49	.0297	62.81
20	40.00	3520	.0275	96.80	136.80	17.5	112.86	101.58	.0288	60.94
25	50.00	4400	.0275	121.00	171.00	20	136.80	123.12	.0279	59.09
30	60.00	5280	.0275	145.20	205.20	22.5	159.03	143.13	.0271	57.25
35	70.00	6160	.0275	169.40	239.40	25	179.55	161.60	.0262	55.40
40	80.00	7040	.0275	193.60	273.60	27.5	198.36	178.53	.0253	53.55
45	90.00	7920	.0275	217.80	307.80	30	215.46	193.92	.0244	51.71
50	100.00	8800	.0275	242.00	343.00	32.5	230.85	207.77	.0236	49.86
75	150.00	13200	.0275	363.00	513.00	35	333.45	300.11	.0227	48.01
100	200.00	17600	.0275	484.00	684.00	40	410.40	369.36	.0209	44.32

INTERMITTENT CHARGE.

—Discount Sheet for Meter Readings—

(List price, 10c per kilowatt hour, or 7½c per horsepower hour.)

Meter readings kilowatt (1000 watt) hours per month.	Equivalent to follow steady horsepower.	Per Cent. Discount.	Net Price per kilowatt hour.	Cents per horsepower hour.	Price per year per steady horsepower 3000 hours.	Minimum bill per month.
0— 50	...	0	.10	.075	$225.00	.....
50— 100	.26	5	.095	.07125	213.75	$4.75
100— 175	.53	10	.09	.0675	202.50	9.00
175— 250	.93	15	.085	.0638	191.40	14.87
250— 350	1.32	20	.08	.06	180.00	20.00
350— 475	1.86	25	.075	.0563	168.90	26.25
475— 650	2.53	30	.07	.0525	157.50	32.25
650— 850	3.46	35	.065	.0487	146.25	42.25
850—1050	4.52	40	.06	.045	135.00	51.00
1050—1200	5.58	44	.056	.042	126.00	58.80
1200—1400	6.36	47	.053	.03975	119.25	63.60
1400—1600	7.42	50	.05	.0375	112.50	70.00
1600—1800	8.48	53	.047	.0352	105.60	75.20
1800—2000	9.54	56	.044	.033	99.00	79.20
2000—2200	10.60	58	.042	.0315	94.50	84.00
2200—2400	11.66	60	.04	.03	90.00	88.00
2400—2800	12.72	62	.038	.0285	85.50	91.20
2800—3200	14.84	64	.036	.027	81.00	100.80
3200—3500	16.96	66	.034	.0255	76.50	108.80
3500—4000	18.65	67	.033	.02475	74.25	115.50
4000—5000	21.20	68	.032	.024	72.00	128.00
5000—6500	26.50	69	.031	.02325	69.75	155.00
6500—8000	34.60	70	.03	.0225	67.50	195.00

A minimum charge of one $1.00 dollar per horse power per month on all motors will be made for power whenever the monthly bill as shown by the meter is less than that amount.

MUNICIPAL MATTERS IN COURT

Higher Courts—Rights of a Municipality to Fix Water Rates.

Decisions of the Higher Courts of Interest to Municipalities.

The Right to Change Street Grades for Public Necessity.—The rule that, where a work of public necessity has been performed within a street through the properly constituted officials, under statutory authority and without negligence, no legal liability arises in favor of an abutting property owner for consequential damages, denies a right of action to a property owner for injuries resulting from a change of the grade of a street on which his property abuts. An owner of property abutting on a street has a right of access from his premises to the street, but he may not demand that the grade of the street shall not be changed in case the public benefit demands it, merely because it interferes with his right of access, since that is subject to the rights of the state, through the municipality as its agent, to improve the street or to change the grade when the public necessity demands it.—Morris et al. v. City of Indianapolis et al. (Ind.), 94 N. E. 705.

Liability of Street Railway Company for Sprinkling Streets.—A street railway's duty under an ordinance to sprinkle the part of streets occupied by its tracks is a public one, and enforceable by mandamus. An ordinance requiring a street railroad to sprinkle the part of streets occupied by it is not void as discriminating in favor of users of automobiles and other vehicles who are not compelled to bear the expense.—State ex rel. City of Milwaukee v. Milwaukee Electric Ry. & Light Co. (Wis.), 129 N. W. 623.

Rights of a Dismissed Appointive Officer.—Where an appointive officer was improperly dismissed without notice, and it did not appear by the complaint in his suit for his salary thereafter accruing that any other person had been appointed in his place, the complaint was not demurrable on the ground that plaintiff must first establish his title to the office by *quo warranto* before bringing action for his salary—Leonard v. City of Terre Haute (Ind.), 93 N. E. 872.

Rights of a City Buying Land for a Street.—A city contracting to buy land to widen a street could not undertake with the owner to move his building, make a fill on land retained by him, re-establish fences, etc., nor to indemnify him against risks in moving the building as to persons and property.—Wheeler v. City of Sault Ste. Marie, 129 N. W. 685.

Rights of a City to Vacate Streets.—The court in determining whether there should be a vacation of streets in proceedings authorizing the vacation of plats and streets and alleys thereon, must consider reasonable future requirements, and the fact that the streets are considered necessary for use by the city for water and sewer pipes shows that they will also be needed for use by the general public, and they should not be vacated.—Gale v. City of Cedar Rapids (Ia.), 129 N. W. 737.

Continuation of the Right of Franchise.—Laws 1846, c. 216, created the Hudson River Railroad Co. with power to construct a railroad, commencing in the city of New York and extending to some point on the Hudson river opposite the city of Albany, authorizing the directors to locate their road on any of the streets or avenues of the city of New York, within specified limits, provided the consent of the corporation was first obtained. The act provided that the corporation should continue for 50 years, and by ordinance of the New York City council, passed May 6, 1847, the railroad's route along the streets of the city was specified and confirmed. Under authority of Laws 1869, c. 917, a consolidation of the Hudson River Ry. Co. with certain other corporations that had been formed to operate a continuous line from Albany to Buffalo was made, by which the consolidated company when formed was to continue for 500 years, and succeed to all the rights, privileges and franchises of each of the corporations included therein. Held, that the franchises thus transferred were not limited by the period of the original grants to the consolidated corporations, but that the consolidation operated as a new grant to the new corporation during the period of its corporate existence, thus vesting in the consolidated corporations a right to operate trains over the tracks laid in the streets of the city of New York for the term of 500 years.—New York Central & H. R. Ry. Co. v. City of New York et al. (N. Y.), 127 N. Y. S. 513.

City Not Liable for Debts of Condemned Water Company Incurred in Process of Acquiring Company.—Where, in proceedings by a village to condemn for public use the property of a water works company, the company employed an attorney who ren-

dered services resulting in securing a larger award, the attorney did not acquire any lien on the ward as against mortgage bondholders of the company.—Farmers Loan & Trust Co. v. Weschester County Water Works Co. et al. (N. Y.), 127 N. Y. S. 569.

City Not Liable for Delaying Contractor.—A street contractor having begun work on being notified to proceed under his contract, though he had notified the city that he would not build the street under the contract price because cost of labor and material had advanced while he was delayed in commencing work, cannot recover damages for the city's breach of the contract in so delaying him.—City of Newport v. Schoolfield (Ky.), 134 S. W. 503.

Maintenance of Excavations Under Sidewalks.—If the owner of city lots constructs a building thereon adjacent to a street of the city, and in such construction excavates a large space under the street to be used as a room in connection with said building, and so maintains the same for several years, it will be presumed that such excavation was made with the consent of the authorities of the city, and upon the implied condition that such excavation shall be maintained in proper and safe condition for travel along the street and walks thereon; and the owner of the property will be liable for damages caused by his neglect to so maintain said excavation.—City of Omaha v. Philadelphia Mortgage & Trust Co. (Neb.), 129 N. W. 996.

Individual May Not Obstruct Stream So as to Cause Injury to Property of Others.—Where a city, for the relief of its streets from floods, discharged its sewers into a stream flowing through it, and one placed an obstruction in the stream, causing general injury to property in the neighborhood and to the streets, the obstruction was a nuisance. A city adopted an ordinance for the construction of a conduit of specified capacity for the waters of a stream within the city, and declared that the conduit should be constructed under plans of the city engineer and subject to his inspection. The individual constructing the conduit did not procure any plans from the engineer, and the engineer never approved any plans, nor was he asked to make any inspection of the structure. *Held,* that the city was not estopped from complaining that the conduit did not comply with the ordinance.—Sioux City v. Simons Hardware Co. (Ia.), 129 N. W. 978.

Rights of Cities to Issue Bonds for Acquiring Public Utilities.—An Act authorizing any city to acquire, own and operate public utilities, and to issue mortgage bonds therefor beyond the general limit of bonded indebtedness, provided such mortgage bonds shall not impose any liability on the city, but shall be secured only by the property and revenue of the public utility required, authorizes a city to issue its bonds, within its debt limit, for the acquisition of public utilities, which bonds are a liability against the city, and to issue bonds beyond the debt limit which are secured only on the property and revenue of the public utilities, which bonds are not within section 20, requiring general laws restricting powers of municipalities to contract debts.—Kuhn, Atty. Gen. v. Common Council of City of Detroit (Mich.), 129 N. W. 879.

Liability of Contractor Under Pavement Guarantee.—Where a contract for an asphalt pavement over a stone block pavement bound the contractor to keep the pavement in repair for 15 years, and with a sufficient foundation, and an asphalt pavement would begin to need repairs in 4 or 5 years, the contract will be deemed to contemplate the necessity of repairs during at least 10 of the 15 years, and not to be a guaranty that the pavement, if laid with the best material and workmanship, would not require repairs within the prescribed period on the ground that defects were not due to inferior workmanship or material but to defective plans of the pavement.—Asphalt Paving Co. v. City of New York (N. Y.), 127 N. Y. S. 794.

Pavement Guarantee Does Not Give Sole Right of Repair to Contractor.—A contract to repave the streets of a city and to maintain the same for a specified period after acceptance, which stipulates that the contractor agrees to make repairs, and during the period of maintenance to take up, lay, and restore on notice the pavement over trenches for water and gas pipes and sewers or other purposes, at a speciefid price, does not give the contractor an exclusive right to relay a pavement during the period of maintenance, and the act of the city in permitting a railway company to keep in repair the part of the streets used by its tracks, to take up and repair a street at its own expense by employing another contractor, is not a violation of the contract, since the railroad company, not being a party to the contract, is not bound thereby, and since the city does not agree to pay for such work.—Mack Paving Co. of New York v. City of New York (N. Y.), 127 N. Y. S. 738.

Right of an Individual to Fire Protection.—A property owner in a city has no right of action against a water company on its contract to furnish water to the city at public hydrants for the protection of his property from fires, though his loss may have been occasioned by the negligent failure of the water company to have on hand a sufficient supply to prevent the loss, there being no privity of contract between the property owner and the water company.—Niehaus Bros. Co. v. Centra Costa Water Co. (Cal.), 113 P. R. 375.

Bidding by Councilman on City Work Constitutes Fraud.—Where in an action on a contract for the construction of sanitary sewers for a city it appeared that the contractor was a firm, a partner of which was

a member of the city council at the time of the execution of the contract, evidence of other bids on the same work was relevant on the issue of fraud in procuring the contract. A contract by a city council with a firm, a partner of which is a member of the council, for public work is not invalid, in the absence of a statute, where it is free from fraud, and where the partner did not vote on the proposition nor take any part in behalf of the city in making the contract.—Mayor, etc., of City of Ensley v. J. E. Hollingsworth & Co. (Ala.), 54 S. R. 95.

Maintenance of a Water Works Is Not a Governmental Function of a City.—The operation of a system of waterworks is not such a governmental function as that a city is not liable for injuries resulting through negligence in the maintenance thereof. While this business is quasi public, it is not essentially governmental.—Huez et al. v. City of Atlanta (Ga.), 70 S. E. 71.

Rights of a Municipality in Fixing Water Rates.

An interesting case affecting the rights of a municipality to fix water rates has recently been decided by the Supreme Court of California. The City of Oakland, Cal., undertook in 1900 to regulate the rates of the Contra Costa Water Co. by ordinance. The water company stated that the rates specified in the ordinance were unreasonable and that sufficient opportunity had not been given the water company to show that the rates were oppressive. A judgment was rendered for the company in 1901 and an appeal to the Supreme Court of the state was taken after a motion for a new trial was denied in 1905. The Supreme Court decision, which was given recently, contains many points of value relative to rate legislation, some of which are as follows:

The court in determining whether water rates for a corporation formed to supply a city with water are confiscatory, must ascertain the value of the property on which the corporation is entitled to a return, and determine the percentage of return to which the corporation is entitled on such value, and where the rates yield less than the lowest percentage of return to which the corporation is entitled the rates are confiscatory.

Th court, in such case, must determine what is the lowest fair percentage, and where an ordinance gives a return which, though low, is not palpably unreasonable, the court may not disturb it.

The presumption is in favor of the validity of a legislative determination fixing rates for water furnished by a corporation to supply a city, and the burden is on the party attacking the rates to show their invalidity.

The provision in the State Constitution, declaring that the use of all water appropriated for sale, rental or distribution is a public use, subject to the control of the state and the rates to be collected for the use of water supplied to any city or the inhabitants thereof, must be fixed annually by the authorities, is sustained on the principle that where one devotes his property to a public use, he grants to the public an interest therein, and must submit to be controlled for the common good.

The exercise of the right by the state to establish reasonable compensation for services where private property is devoted to a public use, is a legislative function, whether the power is exercised directly by the legislature or by a subordinate or administrative body, and the courts have no authority to revise the action of the rate-fixing body.

A city ordinance fixing rates for water furnished by a corporation supplying a city cannot be set aside when enacted in the manner provided by law unless it is invalid on a constitutional ground.

The legislative body fixing rates for water furnished by a corporation supplying a city with water, on determining the present value of the property used in the public service, must fix such rates as will allow the corporation a fair return over and above its operating expenses, taxes and current repairs, and the annual depreciation in the property, and the questions of the value of the property and the amount of expenses, allowance for depreciation and fair compensation, are for the legislative body, and the courts will not set aside its action on the ground that it deprives a corporation of its property without fair compensation, unless that fact clearly appears.

An ordinance which affords a net revenue, over operating expenses and taxes, of 5.682 per cent. on the value of the property used in the service, cannot be adjudged invalid as fixing so low a rate as to be confiscatory, though there must be deducted a fair allowance for the ordinary annual depreciation in the value of the perishable portion of the plant.

A corporation is not entitled to any allowance in the annual fixing of rates to cover any past depreciation, but it is the value of the property at the time of fixing the rates that must be ascertained, and the only depreciation that can be allowed is such as may properly be apportioned to the year for which the rates are fixed.

Such corporation having a monopoly is not entitled to an allowance for good will in determining the value of the property used in the business on which it is entitled to a return.

In the absence of a finding on the question of the value of the property of the corporation, the court cannot determine that the compensation afforded by the ordinance is not reasonable, and, where reasonable, the corporation cannot complain in the courts because of the methods used by the city council in arriving at the conclusion embodied in the ordinance.

FIRE DEPARTMENT

A European Fire Department—Specifications for Fire Hose—Motor-Propelled Fire Apparatus.

A European Fire Department.

The report of Consul General Robert P. Skinner from Hamburg, Germany, contains a description of the fire department of that city and a comparison of this with American fire departments. This report is abstracted briefly as follows:

While the Hamburg fire department is an admirably organized institution, one of the best, if not the best, in Europe, and well adapted to local requirements, it may be doubted whether in the organization of its personnel or in its equipment it is in advance of the fire department of American cities of first rank. The local engines and all mechanical devices seem small, the signal boxes far apart, and the speed maintained in traversing the city rather slow, but as there is an established building line in Hamburg, as in all European cities, which seldom exceeds six stories, the extremely difficult problems that present themselves daily to firemen in American cities are here entirely unknown.

A Hamburg fireman who had occasion to visit the United States some years ago returned full of admiration for the splendid way in which American fire companies usually respond to alarms, and was of the opinion that the American companies were ready for action more promptly than those in Germany, because the individual units subordinated everything else to the point of leaving quarters, at the earliest possible instant, to do which the American firemen at night would slide down the pole partially clad, and was indifferent as to his appearance in riding to the scene of the fire, so long as he was on the spot to meet the emergency The European fireman, on the other hand, having had military training, would be inclined to avoid the pole, and would walk down the stairs, devoting a few seconds to the adjustment of his garments, and would be ready to appear before the public in regulation costume.

The Hamburg fire department is under the general direction of a branddirektor, who has under him two inspectors and nine brandmeisters, these latter being stationed in various city districts. There are 404 firemen and drivers, 114 inside men, and six office men. The brandmeisters are professional engineers who have passed examinations as such. The men composing the companies have had military training, necessarily, and must also have had some technical experience as carpenters, plumbers, electricians, locksmiths and the like. It is the duty of the chief, or branddirektor, not only to fight fires, but to enforce the city ordinances in regard to chimney cleaning, the handling of explosives, and the manufacture thereof.

The fire department renders aid in case of accidents and in removing interruptions to traffic. The direktor is also in possession of very elaborate data from the building department, which are distributed in all the local stations, showing the exact nature of all structures, these data being carefully studied and so prepared that upon reaching the scene of the fire the commander of the company is fully aware of the material situation.

The average time required in Hamburg for a company to be ready to start to a fire is under 18 seconds in the daytime and from 35 to 40 seconds at night. Alarms are sent in from boxes of the Siemens & Halske type combined with Morse telegraphic apparatus. There are in Hamburg 218 general alarm boxes, of which 16 are in the interior of buildings. Theoretically no box is more than 250 meters (820 feet) distant from any building. There are also 134 special alarm boxes in theaters, hospitals, and factories. To facilitate finding an alarm box in time of danger, signs are painted upon or next to every city letter box.

The equipment of the Hamburg department consists of 8 large and 14 small steam fire engines, 1 being a motor engine; 10 gas engines, 1 mounted on an electric motor; 11 hose carriages, 1 with an electric motor; 10 ladder carriages, 1 with an electric motor; 8 tool wagons; 1 tender; 25 ordinary hose reels; 15 hand-pressure fire engines; 3 tank wagons; and various service vehicles, including 49 bicycles.

For service in the port, in addition to the shore equipment, there is 1 fire boat owned by the city, supplemented by 16 ferryboats, which are equipped with pumps and other apparatus. These ferryboats, though used constantly for the transportation of passengers within the harbor, are subject to instant call in case of danger, answering a large fire bell which can be heard throughout the port. The companies owning these ferryboats receive a certain compensation from the government for thus aiding in the work of fighting fires.

In addition to the public organization described above there is a salvage corps working in harmony with the fire depart-

ment, but wholly under the control of the insurance companies doing business in the city, which support the institution entirely at their own expense. Detachments from this corps visit every fire and concentrate their efforts solely to saving property. The salvage corps owns 1 large motor wagon, 2 small motor wagons, a number of 3-wheel small motors, and a considerable number of motorcycles.

Specifications for Fire Hose.

At the recent annual meeting of the National Fire Protection Association there was presented a set of specifications for fire hose which are a great deal more of value than those which were in general use. Owing to the increased demand for first quality rubber in the manufacture of automobile inner tubes and other uses, it has been noted that the quality of rubber used in the fire hose was deteriorating. In many cases inferior grades and even reclaimed rubber has been used for fire hose.

Another fact which allowed of inferior quality hose was the practice of buying it under a short term guarantee. In many cases, the manufacturer furnished hose which he knew would in all probability last during the guarantee period. In fact, he many times figured that a few replaced sections would be necessary; but the cheapness of manufacture fully protected him against such replacements.

In preparing the new specifications, the committee of the National Fire Protection Association tested a number of samples of hose submitted by various cities, and found them almost without exception to be very poor.

The most common as well as the most important defect brought out in the investigation relates to the rubber linings employed. Extended analyses show that the percentage of gum used varies from about twenty-six (26) to fifty-two (52) per cent. and that low grade gums are almost invariably used. In only a vew few cases could any claim for high grade rubber have been justified and these did not meet requirements which constitute a reasonable minimum for rubber used in fire hose.

The following summary of the results of the chemical and physical analysis of a total of thirty-two samples will serve to indicate the general quality of the rubber lining used in the hose tested:

Seventeen linings classify as very inferior grade.

Twelve linings classify as low grade.

One lining classifies as medium grade.

Two linings classify as fair grade.

One lining classifies as high grade.

Average tensile strength, all samples	736.8 pounds
Righest average tensile strength for any hose	1,368. pounds
Lowest average tensile strength for any hose	199.5 pounds
Average elongation at breaking point for all samples	8.02 inches
Highest average elongation at the breaking point	11.9 inches
Lowest average elongation at the breaking point	4.2 inches

The defects found in the cotton fabrics of the samples tested were in many cases of secondary importance, the defects in wearing and in some cases short staple cotton were noted.

The cement backing used between the cotton fabric and the rubber lining presented a more serious defect, as in many cases it did not provide a sufficiently reliable joint between the tube and the jacket. Other instances were noted in which the cement had caused corrugations which were evident on the inner surface particularly near the couplings.

The couplings supplied presented one of the most serious defects in the samples tested, as poor machine work and inferior metal caused the rupture of couplings in three cases when short sections of hose were being tested under pressure. The connections provided between the hose and couplings were almost without exception very poor. The cotton fabric was doubled back in the coupling in many cases, and was quite badly cut by the corrugations in several instances. Sand pits and "fins" on the couplings, which would tend to cut the fabric, were also noted.

In the new specifications offered, the following important changes are recommended:

1. That the rubber lining be of the best quality rubber as determined by analysis. That its breaking strength be not less than thirteen hundred pounds per square inch. Further provisions are made relative to elasticity and chemical properties required.

2. That the couplings be of a specified quality weight and quality of brass, made and fitted in a workmanship manner.

3. That the hose shall be of specified weight and flexibility, and shall have a strength under pressure of certain prescribed amounts varying for single jacket, two jacket and three jacket.

4. That the elongation under pressure shall not exceed specified limits, and that the twist and warp under those conditions shall not exceed specified minimum.

The above include the points of difference in the new specifications for cotton rubber lined fire hose. In offering these specifications the committee suggests that they be rigidly enforced, as they embody no features which will tend to hinder or restrain the processes of manufacture.

Motor Propelled Fire Apparatus.

BY LOUIS ALMGREN, JR., CHIEF OF THE FIRE DEPARTMENT OF SAN DIEGO.

The manufacturers of fire apparatus in this country have been carefully watching the development of the gasoline motor for

the purpose of introducing it into the fire department service. A great deal of time has been expended in this field, to the end that satisfactory results have been obtained in perfecting some forms of motor propelled fire apparatus.

We know that most fires are discovered before they get much headway and the amount of damage they do depends upon the time it takes to get the apparatus with the means to extinguish it on the scene. The motor propelled apparatus for average distances to travel is quicker than the horse-drawn apparatus, the greater the distance the more gain for the auto, and its ability at all times to get men and equipment to the fire with the least possible delay, proves beyond a doubt its great value in a business often involving the loss of life and property and hours of hard work; further, it is conceded that men who ride to fires on apparatus ready to go to work at the early stages of the fire are more valuable than men arriving some minutes later; it is a matter of record that most fires are under control within ten or fifteen minutes after they start.

The motor propelled combination hose and chemical apparatus has proven its superior worth over the horse-drawn apparatus. It is considered by fire department officials throughout the country an indispensable fire fighting unit; some go so far as to say that it has obsoleted for use in certain communities the horse-drawn apparatus. It can be utilized to convey persons injured to hospitals; as a fuel wagon, fuel can be furnished to engines more expeditiously, especially when the engines are some distance from the base of supply; if necessary it can be dispatched to stations for the relay hose held in reserve, and thereby save calling extra apparatus to the fire and jeopardizing the protection already minimized.

It has proven a great success in handling brush and grass fires. As a rule these fires occur in outlying districts remote from the fire limits, and the fact that the auto combination can get to this fire before it has spread to any great extent and extinguish it, return to station and be ready immediately for the next run, demonstrates the superiority of the auto over the horse-drawn apparatus for such service.

Another advantage, while not in the fire fighting line, is important, the absence of horses from the station eliminates the extra labor for their care and the risk of loss by injury or sickness, also the smell and noise, which is an improvement in conditions appreciated by a fireman.

In housing the apparatus economy appears in favor of the auto apparatus, a space ten by twenty feet is sufficient to house it; no stalls, hay and grain rooms, or extra plumbing, heating or sewer connections are required.

The purchase price of the motor propelled apparatus will exceed the horse-drawn apparatus two or three thousand dollars, but this sum is insignificant when the cost of maintaining the horse apparatus is considered, and the fact that the auto will efficiently cover three times the territory that the horse-drawn apparatus will.

In the case of a general alarm the auto apparatus can be concentrated for service expeditiously, which is not true in the case of the horse-drawn apparatus. In cities where motor propelled apparatus is used, all alarms are responded to by an auxiliary squad dispatched in an auto vehicle, the ability of this squad to render efficient service makes it possible to maintain smaller companies in the outlying districts. This is an economy directly attributive to the auto vehicle and should not be overlooked in considering the advantages of the auto over the horse-drawn apparatus.

In small towns and outlying districts where small volume and fair pressure will suffice the combination engine has proven a success, it is also making an enviable record in cities where steep grades abroad, on account of its ability to mount the grades at a high rate of speed and arrive at a fire before it has reached any magnitude.

The foremost manufacturers of fire engines in this country are expending large sums of money in an endeavor to perfect a type of motor engine for fire department use; they promise at an early date an engine that will equal in capacity the second size fire engine.

One of the most important additions to the fire department equipment is the motor propelled aerial truck. This style of truck weighs thirteen thousand pounds, on account of this great weight it has not been practicable to fully secure the service intended for the truck when horse-drawn, motor propelled it has given satisfaction and fulfilled every requirement. A motor propelled chassis attached to a fire engine is another improvement now being experimented with. From reports obtainable it is proving satisfactory.

The speed at which automobile fire apparatus should be driven when responding to alarms, is a matter that should be given careful consideration when preparing regulations governing the operation of same. There have been numerous accidents and loss of life on account of the high rate of speed at which the apparatus has been driven through the congested districts of cities. For safety the automobile should never be driven at a greater speed than 25 miles per hour in congested districts and 30 miles per hour in the outlying districts. Speed can be greatly reduced, however, in the congested districts and still retain supremacy for the automobile apparatus.

The advent of the motor propelled apparatus into the fire fighting business indicates the early reorganization of the personnel of the stationing of apparatus in more centrally houses.—*Pacific Municipalities.*

GARBAGE AND REFUSE

A Foreign Street Sweeping Machine—Pittsburg's Garbage Problem

A Foreign Street Sweeping Machine.

The idea of an automobile-propelled street-sweeping machine is by no means new, but the application of the suction principle to an automobile street-sweeper in Vienna is distinctively novel. The machine referred to is described in a recent issue of the German paper, *Technische Rundschau.*

The construction principle of the machine is as follows:

The cylinder brush which is confined in an iron covering, is manipulated by a motor with chains, and hurls the sweepings against the small opening of a suction funnel, with which a very powerful ventilator is connected.

Through this ventilator a current of air is produced, of which the entrance velocity out of the so-called suction opening amounts to some 98 feet per second. This enormous current of air takes up all the sweepings which are thrown against it. In this way not only the small dust particles, but also the moderately large gravel and loose stones are drawn with it. The mixture of dust and air passes the ventilator and goes through a passage into an especially constructed chamber where the air and dust are separated from each other.

The separated dust falls through an opening on the floor of the chamber into an elevator which elevates it and deposits it in two iron tanks, which are provided.

When these are filled they are taken out either by motor or by hand, empty ones are set in, and the sweeping continues. The capacity of these receptacles amounts to some 2 cubic yards, which means a weight of about one ton.

Since the air is never entirely free from dust, it can not be allowed to return out into the open, but must against be taken back through the brush.

Through this arrangement the difficulties present themselves at the beginning since the opposing air-current owing to its marked velocity of 40 feet per second has a very damaging effect upon the suction and upon the compactness of the machine.

Through an especially patented device, it has after much effort become possible not only entirely to relieve the damaging effect, but make use of it.

Through this achievement is secured in the machine a constant air volume which remains in revolution, and which serves solely as a means of transportation for the sweepings and the air cannot possibly leave the machine.

The exchangeable receptacles in the wagon can, as has been said, take up 1,000 big sweepings, which, by the way, reaches the standard amount of 1,050 to 2,000 feet of street surface. After the sweeping of which the receptacles are changed.

Operating at the average rate a machine can, in five or six hours' work, sweep 70,000 feet of street surface and collect the sweepings. In doing so the service of only one man is needed, since all the manipulation-levers are within reach of the driver.

The dust boxes which have already been filled can, by means of an automobile suitably constructed for heavy work, be collected, and taken outside the city limits.

This kind of street cleaning makes possible a rational disposal of the refuse, since the sweepings can be collected by machinery into a convenient sized box, which can be easily and quickly transported by the transportation automobile to a burning establishment.

In conclusion it may be mentioned that it is possible by keeping up a slanting position of the brush to use the machine in rainy weather. It is only necessary to stop the ventilator, then raise the covering of the brush from the ground sufficiently by means of a simple hoisting contrivance, so that the brush remains upon the ground. Then the cleaning goes on in the usual way.

The new system is especially profitable, not only on account of its hygenic qualities, but also on account of its economical advantage of eliminating almost all the after-work which is done by hand. The community of Vienna, for example, would by strict carrying out of this system on the street area, with forty machines, save some $60,000 annually.

The Pittsburg Garbage Problem.

Dr. E. H. Walters, director of the department of public health of Pittsburg, has prepared a report on the disposal of garbage, rubbish and other waste in the city. The report will be used by council as a basis to work out the problem of spending the $100,000 which was voted in the bond issue of November 9, 1910, for the construction of an incinerator for the destruction of such waste.

The collection and disposal of the city's garbage at the present time is taken care of by the American Reduction Co. and the Allegheny Garbage Co., at an aggregate

cost of $253,500. These companies have reduction plants at West Newton and one at the head of Herrs Island. The garbage is reduced at these plants and the fats collected. The residue is used as the basis for fertilizer. The solder is collected from the old tin cans and the tin is bricketed. There is a great amount of wet garbage to be disposed of by reason of the fact that gas is used almost exclusively for cooking, and therefore the householder does not dispose of the kitchen refuse by burning, as in many other cities.

In order to make an intelligent estimate regarding the quantities to be disposed of, it was decided to make collections of a ward for a few months. The American Reduction Co. offered its services to make such a test collection. The Fourth ward was decided upon in which to make these collections, and in June and July, 1909, the residents were notified by the sanitary officers that for this period the city would collect and dispose of all rubbish. They cooperated with the city officers and the result was that a very accurate accounting of all rubbish collected, as follows:

New fourth ward collections, estimated population, 30,000; number one-horse loads hauled, 209, or 141 tons; two-horse loads hauled, 116, or 138 tons; totals, 325 loads, or 279 tons; average loads per day per one-horse wagon, 3; average loads per day per two-horse wagon, 2; average weight per one-horse load, 1,345 pounds; average weight per two-horse load, 2,396 pounds; average daily accumulation of rubbish per inhabitant, 3,054 pounds; estimated daily accumulation of rubbish for 567,000 inhabitants, 173,162 pounds, or 87 tons; estimated accumulation of 567,000 inhabitants per year, 83,204,057 pounds, or 31,602 tons.

In making his investigations Dr. Walters visited a number of cities, where he inspected the garbage disposal facilities. These cities, which included Cleveland, Buffalo, Chicago, Baltimore, Milwaukee, Minneapolis, Philadelphia, New York, Boston and Washington, gave data on operating cost which Dr. Walters summarizes as follows:

The operating cost of incineration in American cities is variously reported from 23 cents to $2.46 a ton of waste destroyed, exclusive of interest, depreciation and sinking fund charges. The additional fuel is coal and the quantity required varies from 63 pounds to 240 pounds a ton of waste. No city is reported burning garbage or other refuse without additional fuel except by mixing ashes and thereby obtaining benefits of the unburned coal in this form of municipal waste.

The cost of equipment and buildings for an incineration plant for Pittsburg, where there are 110,000 tons of mixed garbage and rubbish per year, or 353 tons per day, at $1,000 per day ton capacity, exclusive of cost of land, would be $353,000. The destroying of street sweepings has not been considered, as the destruction of them by incineration is not considered practical by me.

Dr. Walters suggests the following plan for Pittsburg:

The plan I suggest is one evolved by this department, with the assistance of Mr. Sprague, of the bureau of construction, in which it provides for one central plant and the placing of docks or collecting stations along the river, where barges will receive the rubbish and it will be transferred to the plant, located on city's property in the lower North Side. This plant could be so constructed that in the event of the city deciding to destroy its garbage in connection with the rubbish, the plant could be used as a unit, or enlarged so that it could take care of the collection of the entire city.

As to the cost of this plant, I will give you the facts as briefly as possible:

Ten barges, 10 docks, 1 tug, complete	$ 25,000
Receiving dock, with hoist, conveyors, etc.	7,000
Three furnaces at $10,000 each	30,000
Chimney, etc.	5,000
Building	20,000
Conveying machinery and miscellaneous equipment in plant	2,500
One boiler, generators and motor for handling refuse and for lighting plant	10,000
Total	$100,000

This estimate could be cut down at the present time by using one-half the number of boats and docks, which would be five boats, five docks and forty baskets, making the estimate for the plant $85,000. This, I think, would be sufficient to start with. Other boats and docks could be added as the demand required.

The docks alluded to probably will be pile structures, constructed as inexpensively as possible. They will be provided with timber chutes and hoppers to discharge directly into pontoon boats. The cost of these docks will be about $500 each. The pontoon boats will be of timber about 60 feet in length, 12 feet width and provided with compartments for holding iron buckets, which will be 12 feet long, 77 feet high and 6 feet wide. A barge of this character has been estimated on data secured at $1,000 each. The steel buckets will probably cost between $150 and $175. In the estimate the number of buckets will be approximately 80, and the number of barges 10. The estimated cost of the tug with sufficient power to move these barges would be $5,000.

STREETS AND STREET RAILWAYS

English Use of Tar As a Dust Preventive—Systems for Marking Street Cars—Report on St. Louis Railways—Milan's Electric Plants.

English Use of Tar as a Dust Preventive.

The report of the U. S. consul at Hull, England, makes note of the use of various tars as dust preventives by that city. Gas oil tar, applied as a fine spray, refined oil, delivered to the machine while hot and applied by sprinkling, and a mixture of paving tar and pitch, heated and applied with a brush, were the materials used. The latter material was said by the city engineer to be the most effective as regards dust prevention and road preservation, but by reason of the delay in heating and the comparative difficulty of applying, it was also said to be the most expensive.

On complaint being made that the treating made the road surface slippery for horses, the city engineer prepared a report which is abstracted briefly as follows:

With regard to the streets treated with gas oil tar, which comprise about two-thirds of the total mileage, it does not appear that any complaint has arisen, although it is possible that trouble might occur if the tar was applied over a smooth non-absorbent patch.

Probably most of the trouble has arisen from the use of coal tar from the large machine. It is the practice to follow up the machine when necessary with sand, but it travels over the ground at five miles per hour, and it is quite possible that small areas might either not be reached in time to prevent accidents, or might even be overlooked, especially if a shower of rain follows the application. It does not appear that any of the trouble is likely to arise if the road is in a clean and absorbent condition, but the condition of macadam roads is, of course, far from uniform, and a small area which has been disturbed for a trench, or wetted in any way, or previously heavily tarred, might not absorb the new tar for many hours. The supply of this coal tar is somewhat limited, and it is proposed in future to use it only for the first journey in each day, so that it shall have as long as possible to absorb before dark, and no doubt drivers are now realizing the risk of traveling on wet tar.

As regards the third method of treatment, it is confined to such a small area at one time, and the work is so obvious that there is no excuse for drivers going upon a dangerous area, especially as the tarred surface is sanded whilst still hot.

The permanent effect on the surface has, of course, to be considered, and no doubt anything whatever of a tarry nature applied to a road surface will slightly impair the foothold. The city engineer has communicated with a large number of firms and submits their replies. It may be said that the attitude of the cab proprietors varies from indifference to strong hostility, and that the heavy carters are apparently indifferent. Messrs. Greenwood Brothers state that although there are some disadvantages to horses by causing them to slip and detract from their power, they are outweighed by the benefit to the general public. Mr. Isaac Taylor, the secretary of the Cowkeepers' and Farmers' Association, states that there have been numerous complaints, but that in places where the tar has been thinly applied he thinks it a great benefit.

Complaints have arisen from two other causes, namely, spray from the large machine having been blown on to property or person's dress on a windy day, and in two instances through tar being splashed from puddles where water had been standing when the machine passed through the street. It is fair to say, however, that considering that the length of streets treated must be at least 50 miles, the complaints have been relatively few, and bear no proportion to the appreciation which has been expressed by the general public.

Considering the area to be covered and the dependence of the work upon the weather, tar treatment has now to be considered as high-speed emergency work, and some trouble must inevitably arise from work carried out under these conditions, but with the increasing experience of the men engaged upon it, it may be expected that complaints will become still fewer in number.

Systems for Marking Street Cars.

In the average American city the methods of designating the routes of cars is far from satisfactory, and often confusing to a marked degree. It is customary to place on the front and sides of the car the name of one of the streets which it travels in covering its route. This name indicating as it does only one of perhaps six or eight streets through which the car passes, is particularly misleading to those who may be unfamiliar with the city.

Attention has been called to the Vienna system of designating car routes, a system which is used extensively in Europe, particularly in the German cities. Large let-

ters are placed on the forward end of the Vienna cars, indicating and distinguishing the routes. These letters, which are interchangeable and illuminated at night, seem to make getting about town easier, particularly to the visitor and foreigner, who is not familiar with the city. There is a further advantage in that the car can be identified from a distance, which is often difficult with the naming system. This matter while it seems trivial, is a means of saving a great deal of time, as a passenger will frequently stop a car before discovering that it is not the one he desires.

The system is very commendable and is greatly superior to the usual methods followed in America, but in at least one American city a system has been devised which is an improvement over Vienna's plan. The Boston elevated railroad is at the present time trying a system of car signs which, should it prove popular with the patrons of the road, will be generally adopted.

In former years the cars were identified by colors, but the system became so complicated that it was decided to adopt the system used in European cities or an improvement on it. The numbering system was the result.

Four large signs are placed on the car. Two in the front and back, well upon the hood, and two on the sides. The front and back signs are fifteen inches high and five and one-half feet in length. On the right half of the sign are three figures. The first represents the division or section of the city to which the car goes regularly. The second and third represent the route by which the car proceeds. For a number of years the different sections of Boston have had division numbers. For example, Cambridge is known as Division No. 7. Thus if a car is numbered 756, it would mean that the car was a Cambridge car and would reach Cambridge by the route No. 56. Route 56 might mean by Broadway; by Cambridge street, or whatever the road officials decide upon.

Adjoining the figure is the distinction, written in large letters so the passengers cannot make a mistake. When a car is making its return trip a roll is turned, changing the written distinction. On the side of the car is the written route of the car.

Report of the St. Louis United Railways Investigating Committee.

The committee appointed by the city council of the city of St. Louis to report upon various phases of the traction question has recently returned a very complete report and with a number of recommendations concerning the needed legislation upon a number of points.

One of the first recommendations of the committee, was that concerning the routing of the cars. At the present time the ordinance requires that all cars shall be operated to the end of the ilne, and return. Owing to this fact, and although there are more cars in operation than the law requires, in fact more than the provision relative to the minimum distance between cars will allow, there is great evidence of overcrowding during the rush hours. To remedy this, it is recommended that some of the cars be "short routed"; that is, allowed to make a loop short of the end of the line, during the rush hours. These cars are to be plainly marked to distinguish them from the "long route" cars.

The committee found that the system of transfers as established by the United Railways Company was such as to necessitate in many cases unnecessary travel of several miles, with the consequent loss of time, or the payment of an additional fare. The rules established by the company respecting transfers were violative of the spirit and the contemporaneous construction of the provision of the Central Traction Company ordinance respecting transfers. The company contended that it was complying with the ordinance if it offered a "continuous" ride and gave one transfer. In many cases the rides were, in fact, too "continuous," causing long hauls of the passengers. But long hauls, as all street car transportation experience will prove, are unprofitable to the company itself. If the abuse of the transfer rights of the passenger is eliminated, the company is in a better position to offer a more liberal system of transfers. The conclusions of the committee on this point are embraced in the ordinance introduced with the report.

The provision of the ordinance relating to the transfers is as follows:

Said company shall issue transfers, or a coupon transfer equivalent to such transfers, as the company may elect, to each passenger paying such cash fare and demanding the same at the time of paying the fare, so that such passenger may travel for one fare from any point on said company's system of railway to any other point thereon, by connecting car, within the present limits of the city of St. Louis by the most reasonable and practicable continuous direct route; provided, that the company shall not be required to issue more than one transfer if one transfer will enable the transportation of the passenger as aforesaid.

Provision is also made to prohibit the selling, giving away, or improper use of these transfers.

One rather unique provision of the ordinance reported by the committee is that providing for a supervising board known as the Board of Street Railway Supervision. This board is to consist of three members. The first of these members is to be appointed by the company, and is to receive from them a salary such as they may desig-

nate. The second member is to be appointed by the mayor, and is to receive a salary of $3,000 per annum from the city. The third member is to be chosen by the two first named members and is to receive a salary of $3,000 per annum to be paid in equal parts by the city and the United Railways Company. The members named may be removed at any time by the party who appointed them.

The duties of this board will be as follows:

To hear and consider complaints made against the United Railways Company that it is not observing the terms and covenants of its franchise or contracts, or such general ordinances as have been or may hereafter be enacted under the powers of the city to conserve the health and safety of the public; also to hear and consider complaints regarding the selling or giving away of transfer tickets, or coupon transfer tickets, issued by said company, or improperly using or attempting to use the same, or evading or attempting to evade the payment of fares on its street railway cars, or jumping on or off the cars while in motion, or hanging on or riding on any part of the outside of such cars, and to do and perform such acts and things as have been mentioned in the preceding sections of this ordinance; and also to recommend after investigation, and upon written report to the mayor, such amendments or changes in such ordinances or police regulations as may appear to said board to be advisable.

In addition to these matters, permission is granted to construct a number of lines of track, a settlement is made of the differences regarding the amount of tax assessed by the city, and a number of questions relating to the better operation of the cars are settled. The report shows a careful and full investigation of the problems offered; and is clear and concise in its conclusions.

Milan's Municipal Electric Plants.

The report of Vice Consul James B. Young from Milan, Italy, contains a very interesting account of the water power stations which the city of Milan is completing. These stations, five in number, are located in the Alps and with one steam-power station in Milan form an electric lighting plant, the cost of which is about $6,485,000. With the completion of the plant the present gas street lighting system will be replaced by an electric system.

In time the city will be able to extend the application and use of its electricity and enjoy the benefits therefrom, but at first the project only contemplated furnishing the public streets with illumination, running the city water works and distributing the water, and later supplying private persons and companies with light and power.

Power derived from the mountain streams in the upper Valtelline Alps at Grossotto and thereabout is conveyed across the country for more than 93 miles to Milan. At first a power of 65,000 volts and 27,000 kilowatts wil be derived, but this will be increased later to about 72,000 volts and 50,000 kilowatts, and the 40,000 horsepower will be increased to about 60,000. Two estimates of cost were made. The first contemplated an expenditure of $4,537,430, but this was found too small after the original plans had been enlarged, so a second estimate was made as given above. Power from the plants will be carried to Milan under the form of triphase electrical currents, and the city figures on furnishing to the users about 24,400 kilowatts. The estimated running expenses will be $772,000 a year, or slightly less than 12 per cent of the capital invested. Total receipts have been estimated at about $864,040 a year, which would give the city an annual profit of $92.040.

The estimated cost of the several plants is as follows: Grossotto, the principal station, $1,351,000; Roasco, $231,600; Mazzo, $289,000; steam central, $752,000. Up to the present work has been confined to the construction of the steam plant and the Grossotto central station, the city having deemed it advisable to construct the Tirano and Le Prese plants later, in order to devote more attention to perfecting the municipal management, and to securing the market for electrical energy.

The city also deemed it advisable to connect the Roasco and Mazzo plants with the the energy derived from these two small the energy derived fro mthese two small falls without increasing the expense of the line of transmission, etc., and when these two are built the tension will be increased to 72,000 volts. The distance between the Grossotto plant and those at Mazzo and Roasco being short, the current from these two will be conducted to the Grossotto plant at 10,000 volts, at which tension it is produced, to be transformed by means of step-up transformers to 65,000 volts. Energy produced at Tirano and Le Prese will be transformed to 65,000 volts in the plants where produced, instead of at Grossotto, but afterwards conducted at high potential to Grossotto.

At Milan the current will be lowered by step-down transformers to the same voltage as the current produced in the steam plant, through which the current will enter the city. At a tension of 8,650 volts the current is to be put in the city's circuit, which will carry it either to the rotary transformation central, in Milan, for transformation into continuous current for public arc-light illumination, or to the numerous substations of static transformation, in

which the current becomes reduced to 160 volts and enters the city's system of secondary wires that will carry this current to consumers.

The project includes, therefore, five water-power plants, one steam-power central station, and a receiving and transformation station in connection therewith; the transmission wires from Grossotto to Milan, including 120 substations along the line; the city distribution system; converter station, and the public illumination service.

To bring the power line to Milan 1,710 poles of trellised steel have been erected between that city and Grossotto. These poles required about 4,000 tons of cement for foundations, while some 660 tons of copper wire were used. There is a double row of poles, which are 65½ feet high, weighing 2,866 pounds each, at intervals of 656 feet. The insulators are 15½ inches tall, weigh 50½ pounds, and have a diameter of 15.2 inches.

In anticipation of the expiration of the contract of a large private Italian electric power company (La Societa Edison di Elettricita), which enjoyed a monopoly in furnishing electriciiy for light and power to the city of Milan, the city itself decided to go into the electric-power business and supply its own needs, and, later, the people's as well. The city's contract with the Societa Edison expired December 31, 1904. The communal consiglio of Milan, with this in mind, on December 28, 1903, voted the construction of a municipal power plant, and in connection therewith the immediate construction of a central station at Milan to use steam until the water-power plants could be completed. This generating station, using steam power, has been in operation since June, 1905. Already the city's competition has resulted in a reduction in the prices of electricity charged by private companies.

MUNICIPAL AND TECHNICAL LITERATURE

Books for Engineers.

Wrought-Pipe Drainage Systems. By J. J. Cosgrove. Cloth, 145 pp. Standard Sanitary Mfg. Co., Pittsburg, Pa.

This is another of the practical books on plumbing, written by Mr. Cosgrove for a manufacturing firm, which is also a publisher to this extent. It describes what was formerly known as the Durham house drainage system, using wrought iron or steel pipe, but which, since the expiration of the patents, has been known to the trade, at least so far as the fittings are concerned, as "recessed drainage fittings." The first chapter discusses the differences between steel and wrought iron pipe, the strength of the pipe and its seams, and the various sizes, weights and dimensions. The other chapter describes methods of working wrought pipe, tapping, jointing, reaming, etc.; pipe cutting and threading tools; types of fittings, ventilation fittings, drainage fittings; binding wrought pipe; making up pipe, including tools and materials; measurements and sketches; planning the work; installing a system, including methods of attachment and support of pipe; working polished brass and nickel plated pipe. An appendix describes the welding of wrought pipes by the thermit process.

Clarification of Sewage. By Dr. Ing. Rudolf Schmeitzner, chemist, Germany. Translated by A. Elliott Kimberly, consulting engineer, Columbus, O. 114 pp., cloth, $1.50 net. Engineering News Publishing Co., New York City.

This is the first opportunity that American engineers generally have had to obtain information about the numerous methods of clarifying sewage which have been developed in Germany. English practice has been quite well shown in this country and, under the pressure of state boards of health, English methods of purification have had the most frequent application. There are many places in this country where the German processes described in this book are sufficient, and there are many others where it would seem that they could be substituted for portions of plants which have not proved entirely satisfactory. The translator has recognized this and so presents this brief but comprehensive survey of the field from the pen of one who has had an opportunity to inspect fifteen of the larger German clarification plants and whose ability to observe and criticize is amply shown in the text.

The analysis of each step in each process is carried through according to an introductory schedule of requirements and details of construction and operation are clearly classified in reference thereto.

The design of clarification plants is considered as to site, constructional details, intermittence or constancy of operation, change in character of sewage, protection of operators, nuisances, etc.

Other chapters treat composition of sewage; the component parts of a plant, such

as screens, gratings, scrapers, openings, moving screens, grit chambers, sedimentation devices, sludge removal apparatus, etc., with a statement of the principles of design, and sedimentation towers; sludge removal and treatment for recovery of by-products, apparently not a profitable operation; practical arrangement of clarification and purification plants. A list of full de-descriptions of numerous plants and their location in German publications ends the book.

All who are engaged in the design and re-design of sewage disposal plants will find much valuable material in this little book.

Vitrified Paving Brick. A review of present practice in the manufacture, testing and uses of paving brick. By H. O. Wheeler, E. M., formerly clay specialist of the Missouri Geological Survey. Paper 121 pp., $2.00. T. A. Randall & Co., Indianapolis, Ind.

This is the second edition of a book which has been for fifteen years the standard, if not the only fully reliable book, covering its subject. The addition of about thirty pages and a careful editing of the former edition to bring into it the advances during the years since it appeared, bring the book down to date and keep for it the position of leadership which the first edition immediately assumed. The principal additions are the complete description of the standard rattler, absorption and crushing tests, the N. B. M. A. standard method of conducting the rattler test; a number of descriptions of other kinds of pavement, such as macadam, wood, asphalt, stone blocks; methods of comparing values of pavements; data on life and cost of brick pavements, tables of results of tests; the St. Louis specifications for brick paving, including forms of contract and bidding blank; and the National Paving Brick Manufacturer's specifications for laying paving brick.

The Prevention of Industrial Accidents, No. 1, General. Prepared by Frank E. Law, M. E., and William Newell, A. B., M. E. Paper, 196 pp., 25 cents. The Fidelity and Casualty Co., New York City.

After a brief chapter on the general precautions to be taken by employers and employes in preventing accidents, the authors take up the safety devices that have been invented under the general headings of steam boilers, engines, electrical apparatus, elevators, the factory in general and wood-working machinery. Special industries and their particular devices are treated in separate pamphlets.

The uses of the devices described are given in considerable detail and the book is most valuable for those engaged in mechanical pursuits, and will give the engineer many pointers on the safe operation of plants which he may be called upon to design.

Sewage Disposal. By Leonard P. Kinnicutt, C. E., A. Wilslow and R. Winthrop Pratt. Cloth, 462 pp., $3.00 net. John Wiley & Sons, New York City.

This triple authorship makes possible a general survey of the field of sewage disposal from all points of view, for Professor Kinnicutt is a professor of sanitary chemistry and has been the consulting chemist of the Connecticut Sewage Commission; Professor Winslow is in charge of the biological work in the sanitary research laboratory and sewage experimental station of the Massachusetts Institute of Technology, and Mr. Pratt is the chief engineer of the Ohio State Board of Health and was at one time director of sanitary engineering in Cuba.

The introduction discusses the sanitary demand for sewerage and sewage disposal. The chapters take up the composition of sewage, disposal by dilution, screening and straining, preliminary treatment by sedimentation, by chemical precipitation, and by the septic process, disposal of sludge, purification by broad irrigation and sewage farming, by intermittent filtration through sand, in contact beds, on trickling or percolating beds, disinfection of sewage and sewage effluents and analysis of sewage and effluents.

Results of the classic experiments in America and of the application of their principles in the treatment of city and town wastes are given in reasonable detail. The point of view is always that of the scientific investigator, the technical observer, rather than the practical designer and constructor. This is fortunate in one sense, because the young constructing engineer is likely to be restricted in his view and to put too great emphasis on the particular kind of work he has done. But, the designer, looking for guidance in detail will find himself lost, sometimes, in the wealth of material, concerning the choice of which he finds little or no direction. Again this is fortunate in a sense, because the variety of detail is evidence of the fact that the experimental stage is still passing and if the reader were led too definitely into any one line he might find that he would be misled, the conditions in his own case being such that that course would not lead to success in his case. He must, perforce, work out the problem for himself, by steady experiment, and will find the book of value because of its breadth of view and variety of practice.

There are some omissions in the early history and the demonstrations of some of the theses advanced are somewhat too brief to be entirely convincing, but the book meets a need that has been felt ever since Rafter and Baker's big book got out of date, and will be a good basis for a number of monographs or books on details of design and construction, which will doubtless appear when practice becomes somewhat less experimental and a plant is built which is not outgrown before it is put in operation.

CURRENT INFORMATION

Wood Block Pavement Recommended for Chicago Streets.

Charles K. Mohler, consulting engineer for the Loop Protective and Improvement Association, has presented a report regarding the use of creosoted wood block paving in the central business district of Chicago. In his introduction to this report Mr. Mohler states that the pavements in the business district of Chicago have for years been almost intolerable. Among the defects noted are: Rough and uneven surface; noise from traffic; dirt and dust; difficulty and expense of cleaning, and slippery surface of blocks.

In outlining the requirements for the ideal pavement for heavy traffic, the following requirements are noted:

First. That the pavement should have a surface that will give sure footing to animals and a firm grip for motor vehicles, to secure the greatest tractive effort, under all conditions.

Second. That it should have a smooth, even and uniform surface, of such character as to offer the least resistance to vehicle traction.

Third. It should be durable and possess uniform wearing qualities.

Fourth. It should be noiseless from the effect of hoof strokes, the wheel contact on the pavement itself or induced rattle and vibration set up in vehicles passing over it.

Fifth. It is desirable that it should be not only clean itself, but easily cleaned of any refuse or litter coming upon the roadway.

Sixth. It should require a small amount of crowning and form a water-proof surface.

Seventh. It should be easy of repair.

Eighth. It should be of such character as to give the most satisfactory construction where junctions have to be made with such obstacles as street railways, manhole covers, etc.

Ninth. The cost should be reasonable.

As regards the use of creosoted wood block pavement which Mr. Mohler states to be the nearest to ideal for the loop district, the following are the recommendations noted:

TIMBER.

The kinds of timber best adapted for the manufacture of the block does not seem to be well settled. Long leaf yellow pine has probably been most extensively used. Tamarack has been largely used in Minneapolis, and I believe with quite satisfactory results. Black gum is quite extensively used in some localities. Almost any sound wood with the required amount of crushing strength may be expected to give good results when properly seasoned, treated with preservatives and well laid.

TREATMENT.

The amount of creosote oil per cubic foot of timber called for by the Chicago specifications is sixteen pounds. Some cities require from twenty to twenty-two pounds per cubic foot. My judgment would be in favor of the larger amount or all that can be forced into well-seasoned timber under the best method of treatment. The reason for the higher degree of impregnation is to exclude water or moisture to the greatest degree possible. That should be done for two reasons:

First. With the absorption of moisture the blocks swell an objectionable amount and then shrink when dried out.

Second. Wood has much greater crushing strength when well seasoned and dry than when damp or wet.

If the blocks absorb too much water there is danger of them swelling to the extent of bulging the pavement. When soaked with water or even damp the blocks become soft and will crush and broom under traffic much more readily than if thoroughly dry. A wet block will have about one-half the crushing strength of one well seasoned and dry. That is probably why the destruction of wood block pavement is comparatively rapid when rutting and brooming is once started. For heavy traffic streets a much lighter charge of preservative would be effective if only provision against decay were required. With the heavy charge of oil there will be more of what is termed sweating or bleeding (oil oozing from the blocks). In damp weather that leaves the surface of the pavement more or less "smeary" and "greasy." Until the pavement has aged sufficiently to quit sweating, the difficulty may be largely remedied by spreading clean, sharp sand or gravel over the surface when conditions require.

OIL.

As above stated, one of the most essential requirements of the preservative is that it shall exclude moisture from the blocks. In fact, for such pavements as we are considering the exclusion of moisture to the fullest degree practicable, to keep the wood dry and hard and wear resisting, becomes, if anything, the factor of prime importance. This is especially the case when tall buildings are on each side of the street and the elevated structure in the center of the roadway, leaving the pavement in shadow practically all the time. More particularly is this true at points where it is covered with stations and platforms. The pavement will unquestionably be damp and wet most of the time. Such being the case an oil with a high specific gravity is to be preferred. Asphaltum oil or pitch might give good results.

LAYING.

An ideal or wholly satisfactory method of laying the blocks seems not to have been devised. Longitudinal and transverse expansion joints have been commonly employed when the blocks were laid on a sand bed with sand filler to prevent bulging when the blocks become heated or water soaked. To my mind both transverse and possibly to some extent longitudinal expansion joints are objectionable for two reasons:

First. If the joint closes up the row of blocks on each side usually are pushed up enough to form a ridge across the roadway.

To this rise in the blocks is added the pitch that is squeezed out of the joint.

Second. If the joints do not close up then the pitch is gradually worn out from between the rows of blocks and a rut left the entire width of the roadway. This is subject to rapid wear and increases by calking of horses' shoes and pounding of wheels on the exposed edges of the blocks. When the blocks are set in mortar, expansion joints cannot be introduced. When used in conection with the sand bed there is the objection that, when adjoining blocks of different height are brought to an even top surface, the bedding of the blocks may be too much disturbed when the blocks can move laterally. On account of the arch or crowning of the roadway cross-section from which heaving or "exploding" may result when expansion takes place and from the fact that the longitudinal expansion joints are in the gutter and subject to little wear, there is more reason for and less objection to their use than there is for transverse expansion joints.

The aim should be to get the blocks so laid that they will remain exactly in the position in which they are placed regardless of traffic movement, weather conditions or temperature changes.

LAYING BETWEEN THE RAILS OF THE CAR TRACK.

Perhaps one of the most aggravating obstacles to securing a uniformly good and even roadway surface is the street railway tracks. The paving inside the tracks and the outside junction with the rails is hardly ever found in good condition in a comparatively short time after laying.

The paving between the track rails is subject mostly to the calking of horses' shoes. This is especially aggravated at points where the tie rods are located. A pavement on which can be seen much of the bad effects of this kind of wear may be found on Dearborn street, between Madison and Jackson. Wherever a tie rod occurs the spacing is apt to come out so as to require thin or narrow closures. Some of the narrow closure work was especially noted on the track laying on Monroe street between Clark and Dearborn during November, 1910.

It is believed that more satisfactory results might be had in the track paving if the tie rods were turned flatwise and thoroughly bedded in mortar so as to form a part of the paving bed. With a three or three and one-half-inch paving block the tie rod space or break could be eliminated by laying the blocks continuously over the tie rods. As previously stated, the greater portion of the wear in the track paving comes from the calking in the transverse joints. By laying the blocks lengthwise of the track the number of transverse joints would be reduced by fully one-half. In addition to that, those that do occur would be broken. I know of no case where these expedients have been tried. It is believed that some such method should be given a thorough test at least to prove or disprove the theory. While the property owner does not foot the bill for the track paving, he certainly has a vital interest in the character of the roadway as effected thereby.

The depth of blocks used in track paving in New York is three inches.

PITCH FILLER.

The pitch filler is the element that is in a large measure responsible for the dirty and objectionable features of block pavement in hot weather. The condition is usually aggravated when damp weather prevails. When it is recognized as a condition to be met and taken care of in the proper way it should not be serious. In damp weather the moisture is absorbed causing the blocks to swell. The heat softens the pitch and helps to expand the blocks, causing the pitch and oil to be squeezed out to the surface.

As previously stated, this difficulty can be pretty well taken care of by proper sand dressing, or possibly scraping off the excess ooze on the lines of pedestrian travel. By the use of the sand and gravel dressing and rolling it into the pitch a thoroughly waterproof wearing surface is formed of tar or asphalt pitch, sand, dust, etc., to take up the wear of traffic and thus preserve the block surface for a longer period.

In this connection it is believed that an asphalt pitch might be used to advantage over tar pitch. It does not get soft and flow as readily in hot weather and does not get as brittle in cold weather. It also has the added advantage that it does not stick to the feet and track about like tar pitch.

Pitch filler should obviate any possible demand for transverse expansion joints, and possibly longitudinal as well.

SAND FILLER.

Sand filler for the joints has been used on a number of the downtown Chicago streets. Owing to the fact that sand-filled joints allow free access of water all around the blocks, and that sand has no elasticity, I do not believe it is a desirable material to use for a filler.

PITCH AND SAND FILLER.

There may be some advantage to be derived by the use of a pitch and sand filler. That method would consist in filling the lower half of the joint with pitch to give a water-tight joint, and the upper part with sand to take up the excess of oil or pitch to give a cleaner surface.

TOP DRESSING.

To get rid of the bad effects of excess pitch and creosote on the surface, and also render the pavement less slippery, it is recommended that a thin even layer of gravel be spread over the surface (either before or after the sand dressing has been applied, as experience may prove to be the better) and well rolled with a heavy roller. By such treatment the grains of the gravel will be forced into the excess pitch, bedded into and between the blocks, and forms a wearing surface of the pitch creosote which might otherwise become a nuisance. It would also produce a surface that is much less slippery than the bare treated-wood surface. In fact, it may, and probably would, remove the objections of slippery and smeary surface altogether. The size of grains in the gravel to range from ½ to ¼ inch in diameter. A granitic gravel should be preferred to secure greater durability.

Paving Reforms in Manhattan.

Borough President McAneny, of Manhattan, has had engineers at work for several months examining and experimenting with types of permanent paving. Mr. McAneny agreed fully with the criticisms which have been turned so frequently of late upon the New York pavements, and he said that within a short time he expected to present to the board of estimate recommendations for a general replacement of the old type street pavements.

The old asphalt pavement was laid upon cobblestones, and these have worn through to the surface and broken into holes. The asphalt is little more than a carpet, and under the pressure of traffic is bound to follow the contour of its foundation. For the last year or two whenever an asphalt pavement has been laid in the city, it has been placed on a concrete foundation.

One of the difficulties of the situation at

present is the fact that the city has no asphalt repair plant of its own. It has had to rely on the services of private companies, and it is often necessary to threaten suits in order to make the companies fulfill their obligations. Mr. McAneny recently recommended to the board of estimate that an appropriation be made for the establishment of a municipal repair plant. He is of the opinion that the contract system, especially with the long-term contracts of from five to fifteen years, now in vogue, will always prove unsatisfactory for repair work.

One of the complications which the borough officials must meet is that many of the streets and squares are known as "park streets," and are taken out from under their jurisdiction and placed under that of the park department. Columbus Circle, Central Park Plaza and Mail street, at the postoffice, for example, belong to this group. Then there is a further division of responsibility between the city and the street railway companies, while the river front streets, including the full length of West and South streets, are under the dock department. To reach effective results Mr. McAneny believes that all this scattered responsibility should be concentrated in the bureau of highways.

Furnace Clinker as Road Metal.

A new road covering has been adopted by the Kensington, England, borough council. It has, moreover, the advantage of utilizing the clinker residue from the municipal dust destructor.

The method of manufacture is, roughly, as follows: On leaving the furnace the clinker is ground under heavy steel rollers, after which it is mixed with molten asphalt in the proportion of three parts, by weight, of clinker to one of asphalt, a certain quantity of oil being added to the compound.

The resulting viscous mass is then conveyed to a press, where it is cut into chunks. These are subjected to a 100-ton pressure, which turns them into solid blocks of about the same size as the wooden paving blocks used on main thoroughfares in London.

On cooling, these blocks are ready for paving purposes. Their cost in Kensington is $20.50 per 1,000.

So satisfied are the Kensington borough council with these blocks that they have decided to use nothing else on their main thoroughfares. The blocks are of a very durable nature, and their surface is impervious and dustless, so that they should require very little expense to maintain and clean, besides practically settling the dust problem, which has reached an acute stage since the introduction of motors.

The surface for traffic presented by the blocks is resilient and noiseless, and as they are non-porous, is unaffected by weather. The Kensington borough council believe that they have obtained the finest road material possible, and its introduction will be watched with great interest.

Asphalt Block Paving in New York.

There is now in course of construction on the roadway of Thomas street, between Broadway and Mercer street, New York City, a new form of asphalt pavement, which the Mercantile and Financial Times claims to be superior to any other form of pavement hitherto in use, whether macadam, Belgian block, Trinidad asphalt or wood block. This pavement consists of what is known as compressed rock asphalt slabs, laid upon a concrete base, finished on top with a thin "rubber" coating of pure rock asphalt. These slabs are composed of natural rock asphalt obtained from the mines in Travers, in the canton of Neuchatel, Switzerland. The rock, after being mined, is ground to powder, which, after having been properly heated, is compressed in special molds under a hydraulic pressure of 3,000 pounds to the square inch. These slabs, when laid, are about ten inches square and one and three-quarter inches in thickness, and are laid upon a concrete base four to five inches in thickness, with a cushion of cement and sand mixed dry, of just sufficient thickness (about one-fourth of an inch) to level up any inequalities of the concrete base, so as to afford a firm and level bed for the slabs. The slabs are laid with the joints as close as possible, in exactly the same manner as tile on a tile floor.

When all the slabs are laid and leveled, the entire surface is sprinkled with water from a sprinkling can, so that sufficient moisture may penetrate through the joints to enable the cement underneath to set. After this, the entire surface of the slabs is covered with a thin coating, not more than one-quarter of an inch in thickness, of pure rock asphalt, heated in kettles and spread over the surface with a wooden float in the same manner as an ordinary rock asphalt sidewalk or floor, and dusted over with a light coating of dry cement, lightly brushed in with a broom. This forms what is called the "rubber" coating, so called from the "rubbery" nature of the wearing surface thereby obtained, which, being composed of pure rock asphalt, the same material as the slabs, forms a comparatively soft yet tough covering, which, while it marks up easily, does not break or wear into holes.

On account of this rubbery character, the surface affords a sure foothold for horses, as their shoes indent the surface sufficiently to prevent any slipping while turning or backing in cold weather, or when the surface is wet or covered with snow.

Contract Work in New Orleans.

The executive committee of the Sewerage and Water Board, of New Orleans decided to recommend to the board that the first work undertaken in the completion of the sewerage and drainage system be the Napoleon avenue canal system, and that the work be let to contractors.

The committee sustained the opinions rendered by City Attorney Moore and Special Counsel Gleason to the effect that under the law the board is bound to advertise for bids, and the board cannot do its own work in completing the sewerage and drainage system.

In connection with the relative merits of the contract system and day labor method Superintendent Earl offered a report, which is in substance as follows:

Experience to date indicates that the board's forces can conduct and organize any construction work as well as any contractor can organize it; that the board can buy as good or better material by contract as cheap or cheaper than a contractor can buy it, and that it can be more certain of getting the character of material and supplies required for the best interest of the work if it is the purchaser direct instead of the general contractor who profits every time he can use a cheaper material.

In the drainage construction the following consideration will show the possible saving to the board by the use of the small contract and force account system rather than the general contract system.

The contractor has to make a bond in a surety company in an amount equal to 25 per cent. of his contract. He has to put up security or collateral to obtain this bond and to pay a premium for it. Unless he is very strong financially this forces him to borrow money to prosecute his work. He has to pay interest on borrowed money and on deferred payments on materials, etc., and to await the completion of his work to get his retainer or final payment, which is 15 to 20 per cent. of the amount of his contract; so that, all told, it will cost him from 5 to 10 per cent. of the amount of his contract to bond and finance it. He will bid for a higher profit, but assume he only makes 10 per cent., and you have a cost to the city above the actual cost of the work of from 15 to 20 per cent.

The contractor will also need a special plant for the execution of his work. He will figure that this plant may never be of any use to him after this particular contract is completed, in which case he must figure the cost of his plant into the cost of the work.

The contractor will understand that the drainage canals to be constructed are dependent upon the existing drainage stations to be kept clear of water; that these stations themselves will be under enlargement at the same time, and if the contractor assumes no obligation for his convenience he will add to his price for the risks of working in canals which are already in operation and through which the drainage of the city must pass. If the contractor does assume any obligations on the part of the board to do anything specific in relieving his work of water, he will claim that the board has not lived up to that obligation, and seek payment for extra work and damage due to its failure. With two or three contractors working as they must be so that any action at the pumping station which helps one will injure another, there will be still more confusion, and each contractor will be morally certain that he is getting the worst of it.

On large contract work the forces of the contractor are handled to get quantity of work, and the board's forces are there to insist upon quality, and the total of both forces has to be paid for by the Sewerage and Water Board, and this total is larger than it need to be if there is no antagonistic interest of this character to be taken care of.

The board possesses the following advantages in getting cheap and good work: It has no bond, interest on borrowed money or retainer to consider. The contractors' profits are eliminated. It can buy the best material and supplies for the intended use without the restraining influence of the general contractor, whose interest lies in getting the cheapest.

It only costs the board 1 per cent. in loss of interest on its funds, as they are extended. Machinery and plant for construction of one work can be transferred to another of a similar kind indefinitely as works are completed, thus only costing its actual depreciation for any particular work. The board has rights and advantages and consideration from other public departments of the city and from public service corporations which it cannot delegate as fully to its contractors.

The work of sewerage construction undertaken in 1908 by the board because of bids then reported to be 30 per cent. too high has given a good example of what the forces of the board can do in this respect. To December 31, 1910, 80.5 miles of sewers were constructed in this way, and the cost to the board for the work was not over $676,000, including all labor, material, supervision, depreciation on tools, machinery, wagons, stock, etc. Exactly the same items constructed at the prices bid by contractors would have cost $1,055,415.33.

Mr. Earl submitted the following statement for comparison of cost of doing work actually done by the Sewerage and Water Board sewer construction forces, calculated on prices bid September 11, 1907, and rejected because too high:

Cost of 80.5 miles of sewers at prices bid on items:	
Area "Y"	$ 479,477.56
"Z"	233,610.93
"27—S"	198,858.80
"28—S"	143,468.04
	$1,055,415.33
Estimated extra work—3 per cent.	31,662.46
Estimated supervision in field —5 per cent	52,770.77
Estimated general expenses	30,000.00
Total cost as above	$1,169,848.56
Actual cost	675,883.86
Difference in favor of construction by force account	$494,514.70
Per cent. in favor of construction by force account	42½

Saginaw's Street Lighting Situation.

An opinion of much importance to the city is that just rendered to the board of trade by Attorney Robert T. Holland, touching the present contract for street lighting and the status of affairs with reference to the possible erection by the city of a municipal lighting plant.

The city last fall commenced the second period of a ten-year contract made with the Bartlett Illuminating Company six years ago for lighting the streets at a price of $60 an arc light per year. The contract was made to cover two five-year periods. Upon the expiration of the first period if neither party to the contract notified the

other of its termination, it was to extend for another five years.

The first five years ended last fall, and neither the city nor the company gave notice of terminating the agreement, so on the face of things the city has entered upon the second five-year period of the contract and is bound by it for something over four years longer.

The fact of the expiration of the first five-year period was overlooked completely by the city, and was not discovered until some months later, when the subject of street lighting was brought to public attention and steps were being taken to bring about its improvement. The question as to whether the contract was binding on the city for the second five-year term, notwithstanding its failure to cancel it, as provided in the contract itself, then arose by reason of the selling out of the Bartlett company to the Saginaw Power Company.

The board of trade, at the same time, took up the matter of municipal lighting for Saginaw, and a committee made a trip to Lansing to investigate the municipal plant in use there. Its observations there were so satisfactory that it came back home favorable to the municipal plant, and the legal phase of the situation was then gone into, this being referred to Mr. Holland for investigation and report.

If the city were bound by the contract for nearly four years longer, the board members felt that it would be too early to take steps toward a municipal plant, but that if it were not, then the matter might be taken up at the present time. There were also questions for the latitude of the city's powers under the constitution and its present charter to build and operate a municipal lighting plant, and these are treated at length in Mr. Holland's brief.

Mr. Holland holds that the contract between the city and the Bartlett Illuminating Co. for street lighting is not legally binding on the city, and may be abrogated by it at any time it desires. He holds that the contract was irregularly made in the first instance and that it has been nullified by the action of the Bartlett Illuminating Co. in selling out to the Saginaw Power Co. in violation of an ordinance which forbade it to sell and provided a forfeiture of its rights and privileges in case of such sale.

Mr. Holland advises the city, however, to proceed with caution in dealing with the Saginaw Power Co., saying that unless carefully handled, the city will, by ordering new lights or in some such way, recognize the assignment of the contract to the Saginaw Power Co., and thereby estop itself from questioning its validity.

He gives the opinion that at present the city's sole source of authority for building a municipal plant is the city charter, and that under it such a plant would not be contrary to the old constitution of 1850. There might, however, be a question unless the plant was built for supplying electricity to the municipality only. He also holds that the city could not now issue the $75,000 bonds voted in 1900 for the erection of a municipal lighting plant.

If the city charter is revised under the home rule act Mr. Holland holds that an affirmative vote of three-fifths of those voting would be necessary to authorize a municipal plant and that women taxpayers could vote.

Proposals to Furnish Water to Richmond, Ind.

The city of Richmond, Ind., is confronted with the problem of providing for a permanent water supply system by reason of a clause in the franchise of the corporation which is at present furnishing water. This clause provides for the purchase of the plant by the city, provided that satisfactory arrangements can be made, and for the termination or renewal of the franchise, depending on the action taken by the city.

There has been in addition to the offer of sale submitted by the Richmond City Water Works, the corporation which at present operates the water works system, a proposition from another company which has been formed for the purpose of constructing and operating a water supply system.

The proposition of the Richmond City Water Works Company is, briefly, as follows:

The city has the right to acquire the plant at any time upon giving notice at least six months in advance in writing. Three disinterested engineers, one named each by the city and company and the third selected by the two, shall be chosen to fix the valuation of the plant and system.

First—The water works shall first pay all expenses of operating said works and system and of maintaining the same in a state of efficiency, including taxes, salaries, expenses of making valuations and all other expenses of every kind and character necessary and proper for the operation thereof.

Second—The water works shall next set aside each year a sum equal to one-half of one per cent. of the valuation of the water works and system and computed in the manner hereinbefore set forth, for the purpose of creating a fund to cover replacements and renewals of the plant, and also for emergencies and accidents. If, at any time, the water works shall determine that the sum so set aside for replacements, renewals, emergencies or accidents shall not be sufficient to meet the expenses, then the water works shall have the right to increase the amount of such fund, and with the consent of the city shall have the right to increase the rates charged for public and private consumption of water, so as to cover the necessary increase in the fund, and the city shall agree to a reasonable increase of the rates.

Third—The water works shall next create a depreciation and extension fund by setting aside each year out of its gross income a sum equal to one per cent. of the valuation of the plant, to be determined as provided herein. The fund shall be used for the purpose of making extensions and for such betterments as shall not be paid for out of the replacement and renewal fund.

Fourth—The water works shall next retain out of its gross income and pay, as the same falls due, the interest on its outstanding bonded indebtedness at the rate of five per cent. per annum, payable semi-annually.

Fifth—The water works shall next retain out of its gross income a sum equal to six per cent. upon the amount remaining after deducting from the total valuation of its plant and system, fixed in the manner herein provided, the total amount of its bonded indebtedness, which remainder is hereinafter called "net valuation;" and said six per cent. so computed shall be paid by the water works to its stockholders as dividends.

Sixth—The amount of the gross income of said water works remaining after all of said payments and deductions shall have been made therefrom, shall be equally divided between the water works and the city, and one-half thereof shall be retained by and shall belong to the water works and shall be paid by it to its stockholders as dividends, and the other half thereof shall be paid and shall belong to the city; provided, however, that in the event the aggregate amount to be retained by the water works as dividends in any year, as hereinbefore provided, shall exceed 8 per cent. upon the "net valuation," to be ascertained as provided in clause five above set out, then the entire excess over the amount necessary to pay the water works the dividends of 8 per cent. per annum upon such net valuation shall be paid and shall belong to the city. If the rates for water service as fixed by this ordinance shall not furnish a net return of 6 per cent. on the net valuation to the water works as herein provided for, the rates shall be increased by the water works, so as to provide for such return.

The plan mapped out by the Edwin M. Campfield Company, the new corporation, and offered to the city in their bid, if the contract is awarded to them, is explained as follows: "To organize a company of $825,000 capital stock, $625,000 of which shall be common stock, non-voting and non-participating stocks, which shall not be sold, but shall be placed in the hands of a responsible trust company, to be purchased by the city in annual installments of $31,000 each until the total of $625,000 of common stock is exhausted. The other $200,000 of stock will be preferred stock and will be the sole voting and participating stock of the company; of this amount the city shall take $50,000 at par, and the new water works company shall hold the remaining $150,000 until the final consummation of the purchase by the city. The money to construct the plant will be raised by a bond issue of $775,000 of 5 per cent. semi-annual interest coupon gold bonds, which, with the $50,000 paid by the city in purchase of the $50,000 of preferred stock, will make $825,000, and equal to the total amount of common and preferred stock. Although the city's interest will be small for some time, it will at once have under this plan a one-fourth interest in the start and a one-fifth control in the management by being accorded a representative on the board of directors, and also a one-fourth share in the profits which the city can apply on its annual payment. The annual payment will be $31,000 for 25 years, which in the time will amount to $775,000, or just equal to the bond issue. The $31,000 will be paid by the city into the hands of the trust company holding the $625,000 or common stock, upon the receipt of which the trust company will deliver to the city $31,000 par value of the common stock, and with the funds take up and cancel the $31,000 of the bonds, which will be made to mature in that amount each year. As the $31,000 paid by the city to take up that amount of bonds is applied on the principal or face of the bonds and interest payable semi-annually will have to be paid by the water works company out of the profits, which will amount to $38,750 the first year and decrease annually to the amount of 5 per cent. on the $31,000 paid off each year. When the entire bond issue is taken up the preferred stock held by the company will be surrendered to the city and the entire plant turned over to the city, providing the city has put in all extensions at its own expense. If it has not then the cost of all extensions made during the period will be added to the purchase price, and the city will have to pay for the same in cash or by bonds or some other plan to be agreed upon between the city and the company. As the city will have one-fourth of the profits from the start, and as there will hardly be any extensions for some years after the plant is completed, and as the income will no doubt increase as the city grows, the city will be able to take care of all extensions out of its own one-fourth profit and have some over to apply on its annual installments. If the city cannot save enough out of its present revenues, a very slight annual tax would make up the necessary deficiency.

A New Water Service for Lacombe, Canada.

Lacombe, Alberta, is to have a new water service. A by-law appropriating $20,000 for the purpose is to be submitted to the people soon and will undoubtedly be approved.

ORGANIZATIONS AND INDIVIDUALS

American Water Works Association.

The Rochester convention of the American Water Works Association held June 6 to 9 was one of the most successful meetings of the organization in numbers and interest. About 250 members were present and nearly 550 registered in all.

The program was of unusual value. Particularly valuable papers, long enough to cover their fields with reasonable fullness were that by Leonard Metcalf, Emil Kuiechling and W. C. Hardy, on "Some Fundamental Considerations in the Determination of a Reasonable Return for Public Fire Hydrant Service"; one by George C. Whipple on "Hot Water Troubles"; one by George G. Earl on "Water Rates"; one by T. Chalkley Hatton on "Wood Stave Pipe"; one by Allen Hazen on "Steel and Cast Iron Pipe." Others only less valuable because less comprehensive were presented practically according to the program printed in the June number of MUNICIPAL ENGINEERING.

Two of the papers presented are printed elsewhere in this number of MUNICIPAL ENGINEERING and still more of the excellent material will be given later.

The entertainment features were largely in the hands of the association of exhibitors which performed a heavy service very acceptably, the number to be entertained being present at a dinner at the lake. No one felt like objecting to such excellent treatment, but there was an unobtrusive undercurrent of feeling that the members of the association were being put under almost too much obligation to their friends the manufacturers of water works supplies without an opportunity to reciprocate or refuse without seeming ungracious.

One most excellent entertainment was furnished by Dabney H. Maury, a former president, who gave an illustrated lecture on the Panama Canal.

The question box was, as usual, an interesting feature, the list of questions having been sent to members in advance so that they were prepared to make their contributions individually to the answers.

Louisville, Ky., received a majority on the first ballot for the next place of meeting.

The following list of officers was elected, there being no contest, except for the presidency:

President, Alexander Milne, superintendent waterworks, St. Catherines, Ont.

First vice-president, Dow R. Gwinn, president water company, Terre Haute, Ind.

Second vice-president, Robert J. Thomas, superintendent waterworks, Lowell, Mass.

Third vice-president, John A. Affleck, president Water Board, Harrisburg, Pa.

Fourth vice-president, George G. Earl, general superintendent Sewerage and Water Board, New Orleans, La.

Fifth vice-president, Theodore A. Leisen, chief engineer water department, Louisville, Ky.

Secretary-treasurer, John M. Diven, No. 14 George street, Charleston, S. C.

Finance committee, H. E. Keeler, chairman, Chicago; Leonard Metcalf, Boston; Charles R. Henderson, Davenport, Ia.

Executive committee, John W. Alvord, Alexander Milne, Dow R. Gwinn, H. E. Keeler, Leonard Metcalf, Robert J. Thomas, John A. Affleck, George G. Earl, Charles B. Henderson, J. M. Diven, Theodore A. Leisen.

Three Cement Shows in 1912.

Three cement shows will be held by the Cement Products Exhibition Co., 72 West Adams street, Chicago, during the first three months of 1912. The places and dates are as follows: New York, Madison Square Garden, January 29 to February 3. Chicago, Coliseum, February 21 to February 28. Kansas City, Convention Hall, March 4 to March 21.

The three shows next year will be so arranged that exhibitors desiring to be represented at all of them may move from New York westward, taking advantage of special freight cars, which will be arranged by the Exhibition Co.

Although requests for space are already being received by the Cement Products Exhibition Co., no applications are considered formally filed until all interested concerns and previous exhibitors are provided with complete information and given ample opportunity to make application for the reservation of exhibition space.

The Technical Schools.

The April number of the bulletin of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., contains the description of courses of instruction for the next scholastic year.

Bulletin 47 of the University of Illinois is on "Magnetic Properties of Hensler Alloys"; bulletin 46 is on "The Spontaneous Combustion of Coal with Special Reference to Bituminous Coals of the Illinois Type";

and bulletin 48 is on "The Resistance to Flow Through Locomotive Water Columns."

The University of Illinois will receive from the Legislature, recently adjourned, for its support for the two years following July 1, 1911, the sum of $3,500,000. Something more than half a million dollars of this amount is for buildings. The College of Engineering, the success of which interests many of our readers, received specific appropriations for maintenance amounting to $192,000 and for a building $200,000 In addition to this the department of Mining Engineering received an appropriation for maintenance amounting to $35,000 and for equipment $25,000. The Legislature in providing for the future support of the university has authorized a one mill tax upon the assessed value of the state.

Technical Meetings.

The sixth annual convention of the International Association for the Prevention of Smoke is in session in Newark, N. J., as this number of MUNICIPAL ENGINEERING is mailed. The gas producer, large power stations, and smoke prevention devices are discussed by experts and smoke prevention ordinances also receive full attention. Among the principal speakers are Prof. R. H. Fernald, U. S. Bureau of Mines; Dr. E. J. Lederle, commissioner of health, New York City, and the chief engineers of the Public Service Corporation of New Jersey. R. C. Harris, smoke inspector of Toronto, Ont., is secretary and treasurer.

The American Society for Testing Materials held its meeting at Atlantic City, N. J., June 27 to July 1. Reports and papers of special interest to our readers are those on specifications and tests for clay and cement sewer pipes, Rudolph Hering, chairman of committee; specifications for building and paving brick, D. E. Douty, chairman of committee; practical tests of sand and gravel proposed for use in concrete by Russell S. Greenman; the absrption of concrete by Abel O. Anderson; the expansion and contraction of concrete on hardening by Albert T. Goldbeck; disintegration of concrete by Alfred H. White; the effect of high pressure steam on the crushing strength of concrete by Rudolph J. Wig; standard tests for road materials, Logan W. Page, chairman of committee; a new consistometer for use in testing materials, by W. W. Crosby; standard methods of testing sewer pipe and drain tile, by A. Marston.

The International Municipal Congress and exposition, to be held in Chicago, September 18 to 30, is developing into a large organization. Japan recently took the preliminary steps for an exhibition of the condition of its municipalities.

New York's second annual architectural and engineering show will be held the first of March, 1912. A special feature of the show hereafter will be architectural drawings, especially those of students and also model construction and arrangements will be made to annually present the new inventions of the year in a special department. Interior decoration and landscape architecture will also be elaborately developed and the conference of architectural and engineering interests will be developed to be held at the same time but independent of the exhibition. A. D. V. Storey is general manager, 110 West Thirty-fourth street, New York.

The annual meeting of the New York Electrical Society was held June 15 at Brighton Beach and an interesting feature was as explanation with examples of the electrical developments at Coney Island and the methods of operating the apparatus.

Calendar of Technical Meetings.

American Society for Testing Materials.—Annual meeting at Atlantic City, N. J., June 27 to July 1. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

Ohio Electric Light Association.—Annual convention at Cedar Point, Ohio, July 25-28. D. L. Gaskill, secretary, Greenville, Ohio.

International Association of Municipal Electricians.—Annual convention, St. Paul, Minn., September 12-15. Clarence R. George, secretary, Houston, Texas.

International Municipal Congress and Exposition.—Coliseum, Chicago, Ill., September 18-30. Curt M. Treat, secretary, Great Northern Building, Chicago, Ill.

Fourth International Good Roads Congress.—Chicago, Ill., September 18 to October 1. J. A. Rountree, secretary, Birmingham, Ala.

International Association of Fire Engineers.—Annual convention, The Auditorium, Milwaukee, Wis., September 19-22. James McFall, secretary, Roanoke, Va.

American Society of Municipal Improvements.—Grand Rapids, Mich., September 26-29. A. Prescott Folwell, secretary, 239 W. Thirty-ninth street, New York City.

League of American Municipalities.—Annual convention, Atlanta, Ga., October 4-6. John MacVicar, secretary, Des Moines, Iowa.

National Municipal League.—Annual meeting. Richmond, Va., November 13-17. Clinton Rogers Woodruff, secretary, North American Building, Philadelphia, Pa.

John H. Gregory.

Mr. John H. Gregory, who is the junior partner in the new firm of Hering & Gregory, has had practical experience for 18 years. He was engaged first in Massachusetts on design and construction work with the Metropolitan Sewerage Commission, and afterwards on design with the Metropolitan Water Works.

He was then Assistant Engineer and later Resident Engineer with Allen Hazen on the Albany filteration plant. Following this he was in charge of designs for the water filtration plants in Philadelphia. Then

he was engaged on the design and construction for the new water supply for Jersey City, N. J.

In 1903 he was principal Assistant Engineer in the filtration department of the Commission on Additional Water Supply for New York City. Following this he was engaged by the City of Columbus, and as Engineer in Charge, designed and built the water purification and softening works and the sewage purification works. He also made for the same city an investigation of the garbage disposal problem, which resulted in the construction of the present work.

Following the completion of these works Mr. Gregory spent nearly five months in Europe examining many of the important works for water supply, sewerage and refuse disposal and other sanitary improvements.

After his return Mr. Gregory was Resident Engineer in Newark, N. J., for the Passaic Valley Sewerage Project, and recently has been Engineer with the Metropolitan Sewerage Commission of New York City.

Mr. Gregory has also been associated with the firm of Hering & Fuller at various times since 1902 in connection with numerous water filtration projects, among which were the Hackensack Water Company, the New Haven Water Company, and the investigations for the report on the new Montreal Water supply.

Personal Notes.

Samuel D. Foster, of Pittsburg, Pa., who has been in charge of the roads of Allegheny county, has been appointed chief engineer of the State Highway Department of Pennsylvania under E. M. Bigelow, M. Am. Soc. C. E., commissioner, at a salary of $7,000 per annum.

Fred T. Barcroft, M. Am. Soc. C. E., of Detroit, Mich., has been appointed a member of the City Plan and Improvement Commission of Detroit.

Oscar Brown has been elected mayor of Lulu, Ga.

Bryan Callaghan has been elected mayor of San Antonio, Tex.

H. E. Christenbery has been elected mayor of Knoxville, Tenn.

Herman Gamper, superintendent of the Columbus, O., city electric light plant, will go to Erie, Pa., in July as superintendent for the Erie Electric Light Co.

David Grotta is the chairman of the new City Plan Commission of Newark, N. J., appointed by Mayor Hansling.

Harrison W. Howell has been elected mayor of Wilmington, Del.

Emory C. Crum has been appointed city engineer at Frederick, Md.

A. T. Dickey is city engineer and W. B. McGarvey is assistant city engineer at Galveston, Tex.

R. K. Compton, for some years assistant city engineer in Baltimore, Md., has been elected chairman of the city paving commission recently appointed by the mayor.

H. P. Mobberly and W. A. Burton have joined in a consulting practice to give attention to municipal engineering, drainage, hydro-electric and railroad work, opening offices at 422 Woodruff Building, Springfield, Mo.

Robert A. Kuss, deputy, is temporarily in charge of the Chicago smoke inspection on account of the resignation of Paul P. Bird.

John C. Watts has been appointed assistant city engineer at Troy, N. Y.

Edwin Hancock, the new city engineer of Lagrange, Ill., is a member of the firm of Ewing and Stone Company, consulting engineers, Chicago.

Charles Seville was assistant engineer to the Massachusetts State Board of Health from 1906 until he went abroad with Rudolph Hering in 1910 to inspect engineering works in France, Switzerland, Germany and England. Among the works examined were the more important ones for water purification, sewage purification and refuse destruction. While in Essen, Germany, he was engaged by Dr. K. Imhoff as an assistant to him for one year, during which time he has been engaged on the design and construction of works for sewerage, sewage disposal and stream corrections. At the termination of his engagement this summer he will be associated with the firm of Rudolph Hering and John H. Gregory in New York.

E. A. James, engineer, of North Toronto, Ont., has been appointed engineer of road improvements in York county.

S. L. Etnyre, city engineer of Council Bluffs, Iowa, for 14 years, has resigned to become superintendent of the water works of the city.

K. D. McLean, formerly sewer construction engineer in the city engineer's office of San Francisco, Cal., has been appointed superintendent of construction for the Board of Harbor commissioners.

John R. Freeman, of New York, will make an appraisement of the Spring Valley Water Company as a preliminary to the purchase of the property by the city of San Francisco, Cal.

James H. Fuertes spent May and June on a report on the sewerage of Para, Brazil, and will return to the United States about July 15.

Joseph W. Hamilton has resigned from the U. S. Reclamation Service to become city engineer of Pasco, Wash.

E. F. Harper is city engineer of East St. Louis, Ill., F. W. Rodenberg is assistant in charge of utlet sewer, and James F. Parr, assistant in charge of streets.

Alfred S. Hirzell is city engineer of Wilmington, Del.

A. M. Hunt, who has had much experience in hydro-electric work and helped convert Los Angeles city railways from cable to

electric power, has been appointed consulting engineer for the Geary Street, San Francisco, municipal railway.

Arthur B. Morrill, of the sewage experiment station of the Chicago Sanitary District, has been appointed professor of hydraulic and sanitary engineering in the University of Tien-Tsin, China.

Dr. Thomas Darlington, formerly health officer of New York City, will work out a general plan for the sanitation of the towns about the manufacturing plants owned by the members of the American Iron and Steel Institute.

J. B. Lippincott, assistant chief engineer of the Los Angeles aqueduct, is one of a committee of four engineers to devise a plan for controlling the lower Colorado river.

Willis S. Jones is city engineer of Pomona, Cal.

G. A. Mann continues as city engineer of Reno, Nev.

C. M. Nixon has been elected mayor of Amite, La.

H. B. Moores is mayor of Henning, Tenn.

Frank K. Mott has been re-elected mayor of Oakland, Cal.

E. A. Peyton is superintendent of water and sewers in Chickasha, Okla.

A. G. Rushlight has been elected mayor of Portland, Ore.

Charles Van Amburgh, Binghamton, N. Y., has been appointed county superintendent of highways.

DeWitt Webb has been elected mayor of St. Augustine, Fla.

R. E. McDonald, C. E., of Kansas City, Mo., is aiding in a valuation of the water plant at Green Bay, Wis., which the city proposes to purchase.

Frank Rumbold is commissioner of public works at Tonawanda, N. Y.

John W. Stevens is president of the board of water supply at Mt. Vernon, N. Y.

Daniel J. Hauer has opened an office in the Park Row building New York City, for practice as a consulting engineer and construction economist.

Messrs. Rudolph Hering and George W. Fuller, hydraulic engineers and sanitary experts of New York City, announce the termination of their ten-year partnership agreement under the firm name of Hering & Fuller, excepting as to certain existing engagements which they as a firm will complete. For all new engagements they will hereafter conduct independent offices at their present address, 170 Broadway, New York City.

Mr. Arthur M. Blanchard, M. Am. Soc. C. E., consulting highway engineer, has resigned from the position of associate professor of civil engineering at Brown Unicersity to accept the appointment of professor of highway engineering at Columbia University. Mr. Blanchard will have charge of the graduate courses in highway engineering which will be established at Columbia University next year.

Messrs. Rudolph Hering and John H. Gregory announce that they have entered into partnership as consulting engineers and sanitary experts with offices at 170 Broadway, New York City, and will conduct an engineering business covering investigations, reports, designs and superintendence, relating to projects concerning water supplies, water purification, sewerage, sewage purification, and refuse disposal.

H. von Schon, consulting engineer, Detroit, Mich., has been engaged by the Gila River Development Co. to make plans for utilizing a 500-foot fall in the vicinity of Silver City, N. M.

H. L. Gillespie, president of the Union Clay Products Co., New York, sailed on June 17th, for an extended trip through Europe.

Mr. George W. Fuller, hydraulic engineer and sanitary expert, announces that he has associated with him as partners Messrs. James W. Armstrong, James C. Harding and James R. McClintock, all of whom were formerly on the staff of Hering & Fuller. Mr. Armstrong had more than a dozen years' experience in general engineering practice, especially in railroad and structural iron work and then for ten years he was on the staff of Mr. George C. Earl, general superintendent of sewerage and water of New Orleans, first in charge of the design of nine sewage pumping stations and later in the immediate charge of the design and construction of the New Orleans water purification plants and appurtenances. Recently he has had immediate charge for Hering & Fuller of the design of water purification plants for Grand Rapids, Mich., Minneapolis, Minn., and Montreal, P. Q. Mr. Harding spent some five years as assistant to Mr. Ernest Bowdich and then for ten years was assistant city engineer of Pittsfield, Mass., in charge of the construction and operation of the sewerage system, sewage pumping station and sewage disposal works. Since 1907 he has been with Hering & Fuller, principally on sewerage work, and has had immediate charge of the design of sewerage and sewage purification works for Atlanta, Ga., Batavia, N. Y., Rome, N. Y., New Brunswick, N. J., Vincennes, Ind., etc., and also investigations of typhoid fever epidemics at Coopertown, N. Y., Wilkes-Barre, Pa., Des Moines, Ia., etc. Mr. McClintock has been for the past five years with Hering & Fuller, partly on designing and partly on outside work, particularly with reference to water works appraisements and the construction of water filters. He was resident engineer on the water filtration plant of Burlington, Vt., and at present is in charge of extensive improvements to the water works and sewerage systems of Clarksburg, W. Va. The offices of Mr. Fuller and his associates will be at 170 Broadway, New York City.

MACHINERY AND TRADE

The Manual of Statistics.

The 1911 edition of The Manual of Statistics has just appeared, being the thirty-third annual issue of that standard publication. It fully covers the many important changes which have taken place during the past year in corporate affairs in the United States and Canada, and gives details of the numerous new stock and bond issues of railroad and industrial organizations. The 1092 pages of this carefully compiled reference volume present a great fund of information for the use of investors and speculators. At the same time it embodies ample information regarding government securities, mining stocks and the grain and cotton statistics. Its utility is increased by an arrangement tendering references to the different sections easy and satisfactory.

The edition also devotes much attention to the new railroad, industrial and mining companies, and gives the many changes in dividend payments which have occurred down to the date of its issue. It is published by The Manual of Statistics Company, 20 Vesey Street, New York. Price, $5.

Expert Development of Trinidad Maltha.

To take charge of a new department which will handle its recently developed Trinidad liquid asphalt products, the Barber Asphalt Paving Co. has engaged the services of Dr. Albert Sommer, whose accomplishments in the field of asphalt chemistry and development have given him an international reputation.

Dr. Sommer came to the United States in 1905 from the Technical University of Dresden, where he was assistant and instructor under Prof. Walter Hempel, who is regarded as the foremost authority on gas analysis, industrial chemistry, and the technology of fuels. Studies in chemistry, physics, electrical, civil and mechanical engineering and geology were followed by graduation at Dresden as diplom ingenieur in 1902 and the degree of doctor ingenieur in 1903, and then by the association with Prof. Hempel.

Until recently Dr. Sommer was in charge of the scientific and development work of the Texas Company, especially directed toward the manufacture and improvement of products from Texas and mid-continent petroleum and their application as solvents and lubricants, and also of bituminous and asphaltic products for paving and road building. In 1910 he was appointed lecturer on petroleum and its products at the School of Marine Engineering of the United States Naval Academy at Annapolis, which position he still holds.

Among the scientific bodies of which Dr. Sommer is a member are American Society for Testing Materials, American Chemical Society, Society of Chemical Industry, American Gas Institute, Verein Deutscher Chemiker, American Society of Civil Engineers, American Society of Naval Engineers, the Engineers' Club and the Chemists' Club of New York.

Dr. Sommer is already actively engaged in the development work undertaken immediately upon the discovery of the Trinidad maltha in the neighborhood of the asphalt lake. He describes this discovery as the "mother substance" of Trinidad asphalt, and one that, having no exact counterpart among the malthas heretofore known to the asphalt industry, is destined to play an important part in the future progress of street paving and road building.

Street Paving in Phoenix, Arizona.

A special committee composed of Joseph H. Kibbey, Dwight B. Heard and Charles Stauffer, recently held a meeting with the various contractors of Phoenix, at which the conditions of bidding were clearly explained and a typewritten statement accompanied by form of bid, furnished each of the contractors. After the opening of the bids the committee went into an executive session. The bids were very carefully tabulated and after their consideration the committee decided that, owing to climatic conditions and the good appearance, durability, etc., that bitulithic should be used.

Orange avenue, Pasadena, is now being paved with the Warren Brothers' mixture and the following cities, where climatic conditions are somewhat to those of Phoenix are using this pavement: Dallas, Tex.; Shreveport, La.; El Paso, Tex.; Atlanta, Ga.; Mobile, Ala.; Birmingham, Ala.; Fort Worth, Tex.; Boise, Idaho., and Newton, Kas.

At a meeting of the Phoenix city council May 12, 1911, the contract was awarded to bitulithic in accordance with the recommendations of the citizens' paving committee.

The Cost of Engineering.

In his testimony before the Public Service Commission of New York on the valuation of the Metropolitan Street Railway, Prof. D. C. Jackson, of D. C. & Wm. B. Jackson, Chicago and Boston, cited as examples the figures on certain work in Boston.

The cost of engineering of the Boston Transit Commission for the East Boston tunnel, taking the cost down to and including contractors' profit as the denominator, was 7 per cent. The general expenses,

which were the administrative expenses of the commission and the commissioners' salaries, amounted to 6.1 per cent. and the interest paid during construction on the bonds and indebtedness was 9.4 per cent. The cost in this case was $3,200,000. In the case of the Tremont street subway, Boston, the cost of which was $4,400,000, the engineering percentage was larger. In the case of the Washington street tunnel, Boston, which cost $8,000,000, the engineer's office expenses were 6.1 per cent, the commissioners' administrative and salary and like expenses were 3.2 per cent, and the interest during construction was 9.7 per cent.

The Hotchkiss System of Steel Forms.

One of the great items of cost in concrete construction of all kinds is the cost of forms. The ordinary wood forms, though frequently reused, are damaged to such an extent that their renewal is a constant item of expense. This is particularly true of the forms used in sidewalk and curb and gutter work.

There has been recently manufactured and sold a system of forms for this latter class of work, which is particularly efficient and economical. These forms, made of steel throughout, are manufactured by the Hotchkiss Lock Metal Form Co., Binghamton, N. Y.

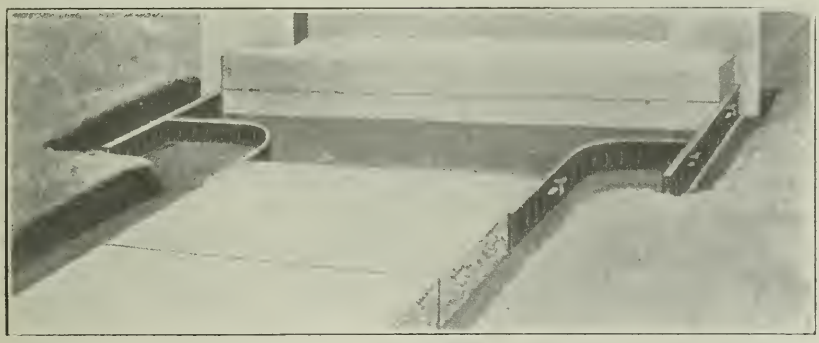
The Hotchkiss steel curb and gutter forms consist of steel templates which conform in shape to the finished curb and gutter. To serve as molds for the back of the curb and the front of the gutter are provided steel channels, which are slotted at regular intervals. On the front and back of the templates are tongues which pass through these slots and are locked there by lugs on the outside. When set up in this manner they form a rigid and substantial form that will stand alone and which does not need any stakes or braces. The accompanying photograph shows the forms in use.

The standard curb form which this company manufactures provides for a twelve-inch curb, 6 inches thick, and with a face 6½ inches high. The gutter is 18 inches wide and dips 1½ inches towards the curb. They are made interchangeable; that is, the same back and front rails are used for either straight curb or combined curb and gutter. Other sizes than those mentioned may be obtained.

The steel sidewalk forms manufactured by this company consist of straight, rigid side rails, flexible side rails, cross pieces or division plates of various lengths, and wedge-shaped keys or lugs for fastening these parts together.

The rigid side rails are 10 feet long, 4 inches high, and have slots at one-foot intervals to receive the division plates. They have a flange at top and bottom to keep them rigid, and in use are joined end to end by a tongue and socket. Rigid side rails are also made 4 feet and 6 feet in length, slotted at three-inch and six-inch intervals.

The flexible side rails are made 4, 6, 8 and 10 feet long, 4 inches high and have no flanges. They are made of spring steel and may be bent to an ydesired curve; for curves



HOTCHKISS STEEL SIDEWALK FORMS

of long radius flexibles are made of heavier steel. The method of use is shown in the photograph. They manufacture to order any desired length. The cross pieces or division plates are simple; all that is required of them is uniformity.

The points of superiority possessed by the steel forms over the old types of wooden forms are:

The saving in cost of form material.

The saving in labor, due to the ease of setting and removing them.

They are more accurate to both line and grade.

They are light and easy to handle and practically indestructible.

Some Notes on Creosoting.

The Wyckoff Pipe and Creosoting Company, 50 Church street, New York, have published a very interesting booklet on creosot-

ing. A short history of the subject is given, which is as follows:

"The preservation of wood is an old art and has been practiced since the beginning of the eighteenth century. In 1705 Homberg soaked in a weak aqua solution of corrosive sublimate. In 1730 Job Baster treated wood with an aqua of corrosive sublimate and arsenic for shipbuilding purposes. In 1740 Reed used wood vinegar. Fagot used alum, iron vitriol and steam. This treatment of Fagot's in 1740 is the first noticed using steam for the preservation of wood. In 1756 Hale treated wood with a solution of tar oil and wood vinegar. About this time the process generally used for preserving wood was to dip it in boiling hot wood tar. In 1756 Jackson used a mixed solution of sea salt, lime, sulphate of zinc, alum, epsom salt, ashes and sea water. From 1767 to 1812 the solutions just mentioned were used in a variety of ways. In 1812 coal tar was first used by Cook for the preservation of ships and ship timber. In 1823 Oxford used for the first time oils distilled from tar, applying them to the wood as paint. In 1835 Moll was the first to use the vapors of wood tar and creosote, the wood being enclosed in tight chambers. In 1838 dead oil of coal tar was first introduced as a preservative of timber by Mr. Bethell in England. In 1848 May also treated wood according to the present method with heavy tar oils or creosote. The wood was first subjected to superheated steam and then to creosote vapors in a cylinder under pressure."

The Wyckoff Company manufactures a type of wood pipe which is extensively used for cable conduits, etc. This pipe is manufactured in eight-foot units of uniform 4½-inch by 4½-inch section and a 3-inch base. The square section admits of the units being used together to carry a cable system having a number of lines. The joints are held together by "mortise-and-tenon" joints.

The conduits, after their preparation, are subjected to the following process: First, they are subjected to live steam under a pressure of between thirty and forty-five pounds to the square inch for from three to seven hours. Second, they are immediately subjected to a vacuum of twenty to twenty-four inches of mercury until all the sap and moisture possible is extracted

Following this treatment, while the wood is still warm from the effects of the steaming treatment and while a 75 to 90 per cent. vacuum exists in the pores of the timber, the oil is admitted into the treating cylinder and is sucked into the pores of the wood by the existing vacuum to the extent of a number of pounds per cubic foot. Hydraulic pressure is then applied and continued until the wood has been impregnated with the required amount. The quantity usually required is twelve pounds of oil per cubic foot, which experience has shown is sufficient to prevent decay in ordinary situations. For some classes of timber, such as oaks and long leaf yellow pine containing quite a percentage of heart wood, a less quantity may be safely employed.

HOTCHKISS STEEL CURB AND GUTTER FORMS.

This thorough treatment has been shown to give a decay-resisting wood, which has been shown in a number of instances to have been in a perfect state of preservation after twenty or more years of service.

The booklet (Catalogue "M") contains a great deal of valuable and interesting material. It will be sent upon request to engineers and contractors interested.

Roads That Pay.

Good roads are expensive, but it costs more money to do without them than to build them.—James J. Hill.

The above quotation, which appears on the fly-leaf of an interesting booklet by the American Asphaltum and Rubber Co., 600-614 Harvester building, Chicago, is aptly descriptive of the facts which the booklet contains. That permanent roads, roads that can endure the wear of the modern automobile, are shown to be more economical than the temporary makeshift road. The results to be attained through the use of "Pioneer" road asphalt in the construction of dustless, waterproof roads are shown in a series of photographs of highways in various parts of the country.

One excellent example noted is the "Peachtree Road" near Atlanta, Ga., which has been called "the Appian Way of the South." This road was constructed in 1909 under the supervision of the U. S. Agricultural Department. Among the other examples of "Pioneer" construction noted are the following: Sheridan road, Chicago; State highway, Wilmington, Mass.; Lyndale ave., Minneapolis, Minn., and Nelson ave., Columbus, Ohio.

The last named road was constructed under the supervision of the Ohio State Highway Department as an experimental road. It was pronounced by James C. Wordens, State Highway Commissioner, to be in excellent condition after a year of service.

The back portion of the book contains points of value concerning the use of "Pioneer" road asphalt and includes a valuable set of specifications for asphalt macadam roadways.

Modern Municipal Illumination.

The Flour City Ornamental Iron Works, Minneapolis, Minn., have issued a catalogue "de luxe" under the above title. This catalogue is attractive is attractive in its execution and contains much information of value to those interested in the live question of ornamental street lighting.

It has become an established fact that the modern system of street illumination is not only an indication of progress and good business conditions, but is actually a factor in producing them. The Flour City Ornamental Iron Works was one of the pioneers in the field of advanced street lighting and has done much to educate municipalities along this line.

The catalogue mentioned contains photographs of a number of types of lighting standards, some of which are familiar through their use in a number of cities. The most familiar one of these, the "Corinthian," was the first standard manufactured by the company and one which has been adopted by a number of the larger cities, among which are Atlanta, Ga.; Duluth, Minn.; Minneapolis, Minn,; Jacksonville, Fla.; Fort Dodge, Ia.; Milwaukee, Wis.; Oklahoma City, Okla., and Winnipeg, Can. This standard, as its name implies, is an adoption of the Corinthian column, with cross arms supporting four ball globes, either erect or pendant, and a center ball supported on a sort of vase. The whole is consistent and offers a pleasing, substantial and dignified appearance.

The other types of street lighting standards shown are the "Capitol" and the "Egyptian," both being manufactured with either the upright or pendant ball globes. Other ornamental standards suitable for use on city halls and other public buildings are shown.

A recent innovation in connection with the ornamental lighting is the substitution of red, blue or other colored center globes near police call boxes. By means of these, flash signals from headquarters may be flashed to any local district. This assures that patrolmen may be reached when needed, for the lights may be so installed as to be visible from all points on any beat.

The Mueller Sewer Rod.

The Mueller sewer rod is made for convenience in opening clogged sewers. It is a continuous strip of special spring steel, tempered so as to allow it to conform to the irregularities of the sewer. It has sufficient strength and spring to keep it from buckling or breaking. When it is withdrawn it becomes a straight steel rod, that can be coiled as it is taken from the sewer.

The working end is provided with a sharp spear point, which will easily penetrate any obstruction in the passage. Just back of the point there are a number of barbs bent outward, but projecting backward from the spear point so they will not interfere with the genetrating force of the rod. By working the rod back and forth it is possible to tear loose the most obstinate stoppage.

By reason of its flexibility it may be made to conform easily to the irregularities of the sewer. It is not clumsy and will work well in a limited space. It will easily penetrate a stoppage.

The rod is manufactured by the H. Mueller Co., West Cerro Gordo street, Decatur, Ill.

Street Lighting as a Feature in Municipal Improvement.

Civic improvement is of paramount importance to the municipality that would keep abreast of the times, and none is more conspicuously necessary in the majority of American cities than that of better street lighting conditions. The sentiment in favor of brighter streets, however, is rapidly gaining ground, and the last few years have witnessed the installation of modern street lighting systems in many of our cities.

Among the cities to realize the importance of proper street lighting, special interest attaches itself to Warren, Ohio, a city of approximately 12,000 people. The street lighting installation which has recently been completed there is one that embodies the most modern ideas on street lighting, since all parts of the city are now lighted by the most up-to-date street illuminant—the Mazda incandescent lamp.

The most spectacular part of the whole system is that in the central business district, where there are eighty-six ornamental standards. Twenty-two of these are placed around the spacious public park, and support a single lamp in an upright position. Directly in front of the court house and near the center of the park are two 5-light standards. The remaining sixty-two units are 3-light standards. The pendant lamps are of 40 c. p. and are enclosed in 12-inch Alba globes, with the exception of the park standards which have 60 c. p. lamps, all the standards have 80 c. p. upright lamps enclosed in 14-inch Alba globes. The wiring of the lamps is such that the pendant lamps can be turned off at midnight, leaving the upright lamps to burn until daybreak.

Although the downtown lighting has received much attention and compares most favorably with the same style of lighting seen in other American cities, the residential streets have not been neglected. The present residential street lighting had its beginning in two trial installations that were installed about two years ago. Such unanimous approval was expressed in regard to the results obtained from these two systems that it was determined to have all the streets in the city equipped with Mazda incandescent lamps. The residential lighting system now installed includes 620 Mazda incandescent lamps suspended from goose-neck brackets, the latter being attached to wooden poles. The units are spaced as uniformly as possible, along one side of each street, and the distance between units on any street depends on the amount of traffic. A much more uniform illumination is produced than that existing with the old system of open arc lamps. All who have investigated the incandescent system are highly pleased and have not been slow to express their appreciation.

MAZDA INSTALLATION IN WARREN, OHIO

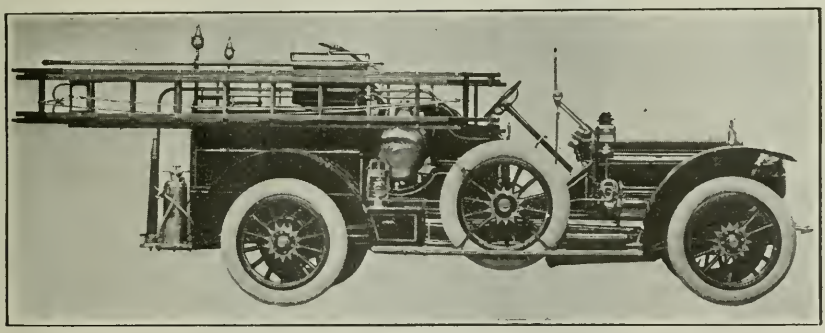
Municipal Service Cars.

The use of motor propelled fire apparatus, patrol wagons and ambulances, has passed the experimental stage and has come to the point where the horse-drawn equipment particularly in the latter two instances, is unusual. The Thomas B. Jeffrey Company, Kenosha, Wis., have a very complete line of municipal service cars, which are the development of a careful consideration of the needs of such service.

The chassis used for these cars are especially built for the purpose. The frames and axles are heavily braced and reinforced by bridge trusses, all forgings being designed with a large margin of safety.

The accompanying photographs show the "Rambler" combination chemical and hose truck. The weight of this car in service is 5,000 pounds. It carries the following equipment: Two 9-in. gas headlights with Prest-O-lite gas tank and instantaneous lighter on the dash, combination oil and electric side and tail lights with separate storage battery (optional). The body has a carrying capacity for 850 to 1,000 feet of 2½-inch hose, which is not included in equipment.

The standard Rambler touring car motor is used and has in the past proven its reliability. It is the four-cylinder water cooled type, the cylinders being cast separately with the heads, valve pockets and water jackets integral. The bore is 5 inches and the stroke 5½ inches, each motor developing 45 horse power. The carbureter is water jacketed and provided with a starting device, which makes starting the motor easy and sure. The oiling is through a mechanical oiler placed on the crank case feeding directly to each cylinder and through splash from an oil level maintained in the crank case itself. Two separate and independent sets of ignition are supplied, although only one set of spark plugs is used. For starting and for running in case something should happen to the magneto, a six-volt, eighty-hour storage battery is provided, which through the coil on the dash, the high tension switch and the Rambler timer, provides one set of ignition. The other set is a high tension Bosch magneto, which delivers its currents to the spark plugs through the Rambler high tension switch, and without using the coil. Either ignition set can be removed, and the car operated upon the other.



1911 RAMBLER COMBINATION CHEMICAL AND HOSE TRUCK

and individual switches on the dash, Rambler folding gas front, Rambler spare wheel complete with tire, brackets and tools, speedometer with clock and electric light, brass bumper, full set of tools, tire repair kit, pump, jack, etc. And the following fire-fighting equipment: One 40-gallon chemical tank with extra acid receptacle and holder, 200 feet best grade ¾-inch four-play chemical hose in 50-foot lengths with couplings and nozzle, perforated steel hose basket with brass rollers, or hose reel (optional), two 3-gallon underwriters' approved hand extinguishers with cups, one 12-foot Pirsch patent trussed roof ladder with folding hooks, one 22-foot Pirsch patent trussed extension ladder, two 8-foot combination plaster hooks and pike poles, one combination door opener and hose shut-off, two pick-back fire department axes with brackets, two brass fire department lanterns with holders, suitable brackets for ladders, pike poles, etc., tool box under rear step, two-nozzle plugs on rear step, two ornamental torches on ladder brackets, rotary gong, or locomotive bell

The tires provided for Rambler service cars are so large as to afford a wide margin of safety, consequently reducing tire trouble to a minimum, but in case of puncture the spare wheel with inflated tire can be substituted for the wheel with damaged tire in three minutes or less. The spare wheel is interchangeable with all four wheels, and the repair when made is permanent. When the car returns to its station, the damaged tire is then repaired, inflated, and thereafter carried on the running board as a spare wheel.

The Rambler motor fire trucks have been shown to be economical under actual service conditions. In a period of five months a Rambler motor fire truck at Kenosha, Wis., answered 39 alarms and made about as many

more inspection runs. The total cost for gasoline, oil and water was $1.37 per month, while formerly it cost $1.25 per day for feeding, shoeing, bedding and doctoring the pair of horses for the fire truck.

Among the cities which are using the Rambler municipal service cars are the following: Whittier, Cal.; Long Beach, Cal.; 21Pomona, Cal.; Decatur, Ill.; Minneapolis, Minn.; Sacramento, Cal.; Harrisburg, Pa.; Dallas, Tex.; Logansport, Ind.; Chicago, Ill.; and Kenosha, Wis.

Fisher Hydraulic Ramming Concrete Machinery.

There has been stated an objection to the ordinary concrete block, on the grounsd that it was not impervious to water, and that it absorbed moisture so as to render it objectionable for building. This objection has been eliminated by the use of Fisher Hydraulic Ramming Concrete Machine, manufactured by a company of that name at Mount Gilead, Ohio.

The principal upon which the machine operates is in the use of a very wet mix driven together by hydraulic ramming until the air is entirely displaced. By displacing the air the aggregate is brought so closely together that adhesion is produced by suction and the mass rendered waterproof.

The wet mix supplies the cement with the necessary moisture to give full crystallization during the initial set. A much less amount of cement is required in this process to develop strength and density.

The machine will make any style hollow block, angle block, veneering, etc. Capacity No. A. machine operated by two men is guaranteed to be over 600 per day. Each block equals 20 brick in wall construction. Architects approve of the process and admit that it produces the most effective cement possible.

The blocks have been shown by test to be practically impervious. Under some tests run by the Johns Hopkins University the following results were obtained:

Sample 1, faced block, weight when dry, 3,005 grams.

Weight after 48 hours immersion, 3,083 grams.

Gain, 78 grams, or, 2.6 percent.

Weight after 48 hours immersion, 3,096 grams.

Gain, 91 grams, or, 3 per cent.

Sample 2, faced block, weight when dry, 3,126 grams.

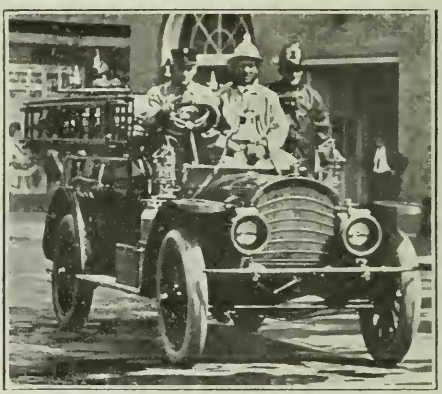
Weight after 4 hours immersion, 3,246 grams.

Gain, 120 grams, or, 3.6 per cent.

Weight after 48 hours immersion, 3,258 grams.

Gain, 132 grams, or 4.2 per cent.

Sample 3, rough block, weight when dry, 3,057 grams.



RAMBLER CHEMICAL TRUCK IN KENOSHA

Weight after 4 hours immersion, 3,090 grams.

Gain, 33 grams, or 1.1 per cent.

Weight after 48 hours immersion, 3,111 grams.

Gain, 54 grams, or 1.8 per cent.

A fire in the plant of the Patapsco Oil and Grease Co., Baltimore, Md., constructed of Fisher blocks, has proven conclusively that they possess great fire-resisting qualities. A fire broke out about midnight in the second story where there were thousands of barrels of oil and other combustibles stored. So threatening was the fire that the second and third fire alarms were sent in and brought out fourteen fire engines which were also assisted by the fire boat "Cataract" throwing a stream from the Chesapeake bay or basin, a distance of about 100 feet, into and against the burning building. This fire was fought with the same precaution, as a wall constructed of brick, expecting that it

would crumble and fall, three of the walls were self-sustaining and exposed. As the roof fell the flames extended high into the air, when this vent was given to the fire, the inside became a roaring furnace of burning oil and oil saturated wood floors and joists.

The blocks were subjected to this intense heat, and while heated quantities of water poured on them, through the openings and from the roofs of the adjoining buildings many streams of water poured in the top of the burning building. The walls remained unaffected, resisting both destructive elements.

The Fisher machine may be operated very economically, requiring only two men to operate. This fact, together with the density and strength of the blocks made, are strong points in its favor.

Trade Publications.

The Vulcan Soot Cleaner Co., Pittsburg, Pa., have a valuable booklet describing the application of their device in economical steam production. The value of the soot cleaner in the saving of labor, economy of fuel and as a smoke reducer is noted.

The Coltrin Concrete Mixer, manufactured by the Knickerbocker Co., Jackson, Mich., is described in a thirty-page illustrated booklet by that company. The application of different sources of power, and detailed drawings and descriptions of parts are given, together with views of the machines in operation.

The Buffalo Pitts Company, Buffalo, N. Y., have an exceptional catalogue descriptive of their special hauling machinery. The contractor's special engine and a number of special "road freight cars," together with their use in road work, are shown. The road cars with their very broad tires, and side, and bottom damp features are unique.

The Warren Brothers Co., Boston, Mass., have published a book entitled "Municipal Powers, the Right of Cities to Purchase Patented Articles Sustained by the Highest Courts." It contains the text of decisions in the various states regarding the meaning of charter provisions requiring competitive bidding.

The June Bulletin of the Lehigh Portland Cement Co., Peoples Gas Building, Chicago. It is a very attractive issue, containing among other photographs, those of the Black Warrior River Improvement in Alabama. A description of the locks and dams is given.

The American Asphaltum and Rubber Company, 600-614 Harvester Building, Chicago, have a booklet describing asphalt macadam roadways and the success of the pentration method of applying binder.

The Water Works Equipment Co., 50 Church street, New York, have a catalog describing their tapping machines, hydrants, service boxes, thawing apparatus and other water works specialties.

The Lead Lined Iron Pipe Co., Wakefield, Mass., have a leaflet descriptive of their pipes and specials, which are unique in that they are lined with lead or tin.

The Water Works Equipment Co., 50 Church street, New York, have a small catalog showing their line of contractors pumps which are manufactured by A. A. Parker, Waterford, N. Y. Full details regarding parts, operation, dimensions, etc., are given.

The Allis-Chalmers Co., Milwaukee, Wis., have three catalogs which meet their standard of excellence in detailed clearness of description. The first of these, Bulletin No. 1411 on "Modern Rock Crushing Plants," contains photographs and descriptions of all machines entering into such plants, together with drawings showing layouts, etc. The second Bulletin No. 1448, contains a description of their Type "K" Breakers, together with tables of sizes, capacities, etc. This has been revised to bring it up to their present practice and contains much interesting information. The third, Bulletin No. 1523, gives a general description and photographs of stationary air compressors for industrial purposes.

The Mueller reducing and regulating valves are described in Catalog No. 2 issued by the H. Mueller Co., West Cerro Gordo street, Decatur, Ill.

Trade Notes.

PAVING.

Oklahoma City, Okla.—The secretary of state has issued a charter to the Severens Paving Co. of this city, capital $30,000. The incorporators are: J. O. Severens, Charles T. Derr and Horace Hayden, Sr., all of Oklahoma City.

MACHINERY.

Fort Wayne, Ind.—Special—On June 1, 1911, the Fort Wayne Electric Works was merged with the General Electric Company of Schenectady, N. Y. Its business is now conducted under the name of Fort Wayne Electric Works of General Electric Company. All correspondence should be sent to the Fort Wayne Electric Works at the same address as in the past.

St. Louis, Mo.—Special—The City of Mansfield, Mass., has just now placed with the Busch-Sulzer Bros.-Diesel Engine Co. an order for an additional 225 horse power Diesel oil engine. This makes the fourth engine installed at the electric light plant of the city of Mansfield, Mass. The City of Granite Falls, Minn., has also placed an order for a 170 horse power engine as an auxiliary for water power in their electric light plant.

Canton, O.—The contract for furnishing two engines for city lighting plant was let to Russell Engine Co., of Massillon, O., $5,975; furnishing generator to Fort Wayne Electric Co., $4,640; furnishing 300 horse power boiler to Wick Boiler Co. of Detroit, $3,294.

Dallas, Tex.—Special—The board of city commissioners will purchase an air compressor to cost $780, two 75 horse power motors, three 50 horse power motors, and one 20 horse power motor.

Milwaukee, Wis—The contract for furnishing 300,000 gallons asphaltic street oil was let to the Indian Refining Co., New York City.

WATER.

MANSFIELD, Mass.—Special—A new corporation recently organized under the laws of the State of Massachusetts as the Langford Composite Pipe Co., of Mansfield, Mass., will manufacture a new type of concrete high pressure water pipe and service pipe under the patents of Mr. G. W. Priest, president of the new company. The pipe offers many advantages over ordinary pipe because of its greater carrying capacity, durability and proof against electrolysis and acids.

MISCELLANEOUS.

Muskogee, Okla.—Special—The secretary of state has issued a charter to the Yellowstone Construction Co. The capital is $25,000 and the directors are David Gunsburg and Ralph Hochsteder, both of Buffalo, N. Y.; H. G. Baker of Muskogee, Okla., and James Connolly of Titusville, Pa.

Philadelphia, Pa.—Special—The Sun Company, producers, refiners and exporters of petroleum products, have removed to the ninth floor of the Morris building.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Bloomfield, Ind.—July 5, 2 p. m. Constructing macadamized road in Jackson twp. C. H. Jennings, audt.

Bloomington, Ind.—July 5, 10 a. m. Constructing highway in Salt Creek twp. Horace Blakely, audt.

Booneville, Ind.—July 3, 2 p. m. Constructing various roads. N. M. Stradley, audt.

Brownstown, Ind.—July 5, 1:30 p. m. Constructing Medora rd. and Sparksville Hill rd. H. W. Wacker, audt.

Evansville, Ind.—July 6, 10 a. m. Constructing gravel road in Center twp. Chas. P. Beard, audt.

Franklin, Ind.—July 3, 1 p. m. Constructing gravel road in Union twp. W. B. Jennings, audt.

Frankfort, Ind.—July 6, 2 p. m. Constructing seven gravel roads. Charles F. Cromwell, audt.

Greenfield, Ind.—July 3, 10 a. m. Constructing roads in Sugar Creek twp. G. H. Troy, audt.

Indianapolis, Ind.—July 5, 10 a. m. Paving Hermann st. C. A. Schrader, pres. bd. of pub. wks.

Kentland, Ind.—July 6, 1 p. m. Constructing macadam roads in Iroquois twp., and stone roads in Grant and Jackson twps. E. R. Bringham, audt.

LaPorte, Ind.—July 3, 10 a. m. Constructing macadamized road in Scipio and Cass twps. F. A. Hausheer, audt.

Logansport, Ind.—July 5, 10 a. m. Constructing stone road in Boone twp. J. E. Wallace, audt.

Logansport, Ind.—July 6, 10 a. m. Constructing stone road in Deer Creek twp. J. E. Wallace, audt.

Monticello, Ind.—July 6, 12 m. Constructing stone road in Honey Creek twp. A. G. Fisher, audt.

Muncie, Ind.—July 5, 10 a. m. Constructing 2 roads. Francis M. Williams, audt.

Newport, Ind.—July 3, 10 a. m. Constructing gravel road in Holt twp. H. T. Payne, audt.

Petersburg, Ind.—July 5, 2 p. m. Constructing stone road in Patoka twp. John D. Gray, audt.

Portland, Ind.—July 3, 10 a. m. Constructing highway in Bear Creek twp. W. Lea Smith, audt.

Rockville, Ind.—July 10, 2 p. m. Constructing gravel roads in Jackson, Parke and Madison twps. J. E. Elder, audt.

Rushville, Ind.—July 5, 2 p. m. Constructing macadam road in Jackson twp. J. M. Stone, audt.

Salem, Ind.—July 3, 1:30 p. m. Constructing road in Brown twp. F. S. Munkelt, audt.

Sullivan, Ind.—July 5, 12 m. Constructing bituminous asphalt macadam road and a stone road. Ben C. Crowder, audt.

Valparaiso, Ind.—July 5, 12 m. Constructing four gravel roads. C. A. Blachly, audt.

Vernon, Ind.—July 3, 11 a. m. Constructing 3 mi. pike road in Bigger twp. M. W. Brogan, audt.

Versailles, Ind.—July 3, 1 p. m. Constructing macadam roads in Laughrey twp. Nicholas Volz, audt.

Wabash, Ind.—July 5, 1:30 p. m. Constructing 3 roads in Pawpaw twp., two in Noble twp., two in North Manchester, one between Noble and Waltz twps., and one between Noble and Pawpaw. J. P. Noftzger, audt.

Washington, Ind.—July 5, 10 a. m. Constructing gravel road in Washington twp. Thomas Nugent, audt

Williamsport, Ind.—July 3 3 p. m. Constructing highway in Mound twp. D. H. Moffett, audt.

Williamsport, Ind.—July 10, 2 p. m. Constructing gravel road in Adams twp. D. H. Moffett, audt.

Corning, Ia.—July 3, 7:30 p. m. Street improvements as follows: Curbing Davis ave., Eighth st., and other streets; paving various streets with brick and concrete, including 12,000 sq. yds. of brick pavement; 189 sq. yds. concrete pavement, and 2,373 lin. ft. curb and gutter. Certified check, $500. Wm. C. Chett, cy. clk. Theodore F. DeLay, engr.

Greenfield, Ia.—July 11, 2:30 p. m. Paving 14,000 sq. yds. with brick or cement concrete paving; 4,500 lin. ft. curb. Certified check, $1,000. Iowa Engineering Co., Chase blk., Clinton, Ia., engrs.

Westfield, N. J.—July 3, 8:15 p. m. Constructing 5,320 sq. yds. of 8-in. bituminous macadam; 5,500 lin. ft. of under drain and 155 lin. ft. concrete curb. Certified check, $500. Charles Clark, twn. clk.

Johnstown, N. Y.—July 3, 7:30 p. m. Constructing asphalt block pavement on South Ferry st., including 2,946 sq. yds. pavement and 1,244 lin. ft. of curb. Certified check, $500. Grover E. Yerdon, cy. clk.

Olean, N. Y.—July 5, 8 p. m. Constructing 9,800 sq. yds. wire cut lug brick pavement. John H. Gaynor, engr.

Wilmington, N. C.—July 15, 12 m. Constructing 24,000 sq. yds. pavement. Certified check, 5 per cent. C. Q. Moore, chrmn. com. on sts.

Brookville, O.—July 1. Paving Market st. Certified check, 5 per cent. H. E. Wheaton, clk.

Celina, O.—July 1, 10 a. m. Constructing road between Darke county and Mercer county. Certified check, $100. P. F. Blade, sur.

Cincinnati, O.—July 7, 12 m. Road improvement as follows: Specifications No. 229 for improvement on Sharon ave., certified check, $2,000; specifications No. 234, for improvement of Springfield rd., certified check, $2,000; specifications No. 232, oiling Carrolton pike, certified check, $500; specifications No. 203, for repairing various roads, certified check, $1,000. Fred Dreihs, clk. Hamilton co. com.

East Liverpool, O.—June 30, 12 m. Paving alley with vitrified brick, certified check, $500; paving Mulberry st. with vitrified brick, certified check. $500; grading Cadmus st., certified check, $500. B. V. Beattey, dir. of pub. ser.

Lakewood, O.—July 3, 12 m. Constructing delinquent sidewalks of stone, certified check, $200. B. M. Cook, clk.

Lisbon, O.—July 3, 9 a. m. Constructing Carpenter's Hollow rd., certified check, 50 per cent. Lura M. Kannel, clk.

Mt. Gilead, O.—July 7, 11 a. m. Paving improvements as follows: Kirk rd., certified check, $500; Mills, rd., certified check, $500; Osborn rd., certified check, $500; Clark and Purington rd., certified check, $500. Clifton Sipe, co. audt.

Ottawa, O.—July 7, 12 m. Constructing Troy co. rd. improvement No. 10, certified check, $500. Joseph Kersting, audt. of Putnam co., Ohio.

Bedford, Pa.—July 1, 10 a. m. Constructing public rd. Josiah R. Richey, sec. bd. of High Springs twp. superv.

Lancaster, Pa.—July 3, 9 a. m. Constructing concrete curb on E. Orange st., certified check, 15 per cent. H. Frank Ashleman, co. compt.

McKeesport, Pa.—July 6, 8 p. m. Paving Fourth ave., certified check, $200. J. O. Stance, chrmn. st. com.

Pittsburg, Pa.—July 5, 10 a. m. Road construction as follows: Buena Vista and Lovedale rd., 2 6-10 mi. of bitulithic; Squaw road, 1⅜ mi. of oiled macadam; Wilmerding rd., ⅞ mi. macadam; Cliff Mine and Coraopolis Heights rds, 4 8-10 mi. of macadam; Buiasuta rd., ⅝ mi. brick; Bakerstown rd., 1-3 mi. macadam; Bakerstown and Valencia extension No. 2, 1,500 ft. macadam. Robert J. Cunningham, co. audt.

Uniontown, Pa.—July 3. Building 10,700 ft. macadam road including all bridges and culverts. Roy W. Elliott, Jackson twp. suprv.

Wilson, Pa.—July 6, 8 p. m. Constructing pavement on Fourth ave., certified check, $200. J. O. Spence, chrmn. st. com.

Parkersburg, W. Va.—July 3, 12 m. Constructing brick pavement as follows: Williamstown rd, Dudley ave., Northwestern pike, Staunton pike, certified check, $2,500 on each bid. C. Skidmore Company, engrs. Wm. Dudley, clk.

CONTRACTS AWARDED.

Little Rock, Ark.—Constructing sidewalks and gutters in Spifft add., to Woodsmall & McCarty, $11,000.

San Francisco, Cal.—Constructing sidewalks, curb catch-basin on Boyce st., to the Federal Construction Co., San Francisco, Cal.

Ocean Park, Cal.—Paving Ocean ave., to Braun, Bryant &Austin; paving alley, to Chas. H. Mattern.

Bridgeport, Conn.—Paving Barnum ave., to W. H. Archur, Stamford, Conn.; furnishing block for same, to U. S. Wood Preserving Co., 165 Broadway, New Y ork.

Gilman, Ill.—Paving Central st., to G. W. Trutsman, Danville, Ill.

Moline, Ill.—Paving 4th ave. with brick, to Britt & Layden, $51,667.

Indianapolis, Ind.—Constructing pavement in alleys north of Vermont st., to American Construction Co., Indianapolis.

Logansport, Ind.—Contract for road improvement has been awarded to the following contractors: F. E. Barnard, Delphi, Ind.; George Emery, Galveston, Ind.; Fred P. Woods, Burnettsville, Ind.; Harry A. Barnes & Son, Logansport, Ind.

Michigan City, Ind.—Constructing macadam roads in Center and Springfield twps., to John A. Young, $18,420.

Harlan, Ia.—Paving Baldwin st., to G. Mancini, Florence, Neb., $15,666; constructing gutters, to Llana Construction Co., Harlan, $2,175; paving, to H. Atkinson, Watertown, S. D., $2,252. John P. Crick, Omaha, Neb., engr.

Washington, Ia.—Paving N. Iowa ave. with brick, to J. J. McKeon, Washington, Ia.

Topeka, Kans.—Constructing 200 sq. yds. pavement, to Luthyjohn & Foucht, $1,100.

Louisville, Ky.—Constructing vitrified block pavement to cost $56,000, to the following contractors: Henry Bickel Co,, and L. W. Hancock Co.

Holyoke, Mass.—Constructing retaining wall in Railroad st., to P. J. Kennedy, Jr., Holyoke, Mass., $11,720.

Uxbridge, Mass.—Constructing electric light plant addition to E. W. Ward & Co., Worcester, Mass.

Mankatopato, Minn.—Paving 16 blocks with creosoted wood block, to The North Star Concrete Co., Mankatopato, Minn.; paving 5 blocks with bituminous macadam, to Fowler & Pay, Mankatopato, Minn.

St. Joseph, Mo.—Paving Monterey st. with mineral rubber asphalt, to the Metropolitan Paving Co., St. Joseph, Mo.; grading Edmond st., to W. B. Kelly.

St. Louis, Mo.—The following paving contracts have been awarded: Benton st., to Parker-Washington Co., 4500 Duncan ave., $45,748; 25th st. with bitulithic, Granite Bituminous Paving Co., $34,734; Howard st. and 21st st. with asphalt, to G. A. Heman, $77.142.

Hastings, Neb.—Paving various streets, to M. Ford and E. R. Bing.

Atlantic City, N. J.—Paving Vermont ave., $109,218, and Congress ave., $1,311, to the United Paving Co., Bartlett bldg., Atlantic City, N. J.

Albany, N. Y.—Paving King ave., to John M. Holler, $12,275; paving Morris st., to Mulderry Bros.

Schenectady, N. Y.—The following paving contracts have been awarded: River road with sheet asphalt, to the Schenectady Construction Co.; paving River road with macadam, to same; DeGraf st. with brick, to Thomas R. Trane; Church st. with sheet asphalt, to the Schenectady Contracting Co.

Syracuse, N. Y.—The following st. improvement contracts have been awarded: Grading Oakland ave., to Anthony Sposato, $811; grading Greenway ave., to same, $9,692; grading Hawley ave., to Samuel Bann, $1,800.

Akron, O.—Constructing pavement on Cedar st., to E. McShaffery & Son.

Canton, O.—Paving 2½ mi., to Frank Downs, Canton, O., $29,397.

Canton, O.—Paving 2 mi. of road, to N. J. McGinty, of Minerva, O., $40, 820.

Canton, O.—The following paving contracts have been awarded to Piero and Palarico: Gibbs st., $17,678; S. Court st., $6,-672; Williams st., $6,518.

Canton, O.—Paving 1 mile of Lexington road, to John Wilson, Alliance, O., $17,607; constructing 1 mi. of Harrisburg road, to same, $18.448. Material to be used is brick on concrete foundation.

Chardon, O.—Paving South pike, to the Cement Products Co., Erie, Pa., $20,385.

Cincinnati, O.—Paving 5th st. and Madison st., to F. J. Ruh Co.

Cincinnati, O.—Improvement of Crookshank rd., to the Joseph Gradison Construction Co., Cincinnati, O., $15,986.

Dayton, O.—The following paving contracts have been awarded: Huffman ave., to J. E. Conley & Co., $40,482; macadamizing Cincinnati pike, to Gebhart & Kline, $10,242.

East Liverpool, O.—Paving contracts have been awarded as follows: Bradshaw ave., to Rinehart Bros; Elm st. and Sugar st., to Freshwater Bros.; St. Clair ave., to John McLaughlin; Virginia ave., to John Ryan & Son; Riley ave., to Rinehart Bros.

Findlay, O.—Paving Ash ave., to D. P. Hall & Sons.

Greenville, O.—The following road contracts have been let: The Duncan rd., to J. R. Smith, $5,890; material, to the Greenville Gravel Co., $4,490; the Monney rd., to F. A. Warner, $13,598; material, to Albert Shafer, $2,300; the W. R. Hittle rd., to Manning &

Walls, $3,483; material to the Greenville Gravel Co., $5,220; the Henelgarn rd., to J. F. Canelltern, $1,398; material, to the Greenville Gravel Co., $2,595.

Leetonia, O.—Paving Main and Chestnut sts., including 14,500 sq. yds. block pavement and 60,500 ft. of stone curbing, to J. G. Maguire & Co., New Brighton, Pa.

Liverpool, O.—The following paving contracts have been awarded: Thompson ave., Blakely, Vine and Fawcett sts., to Hinton & Cunningham, $13,000; E. 4th st. to Freshwater Bros., of Chester, O., $1,850; Railroad and Church sts., to Thomas McLaughlin, 7,500 and $4,900.

Lisbon, O.—Constructing McKinley ave., pavement, to Buell and Baker, of Salem, $7,513.

Montpelier, O.—Paving Empire and Main sts. H. S. Enck, Lima, O., $48,908.

Orrville, O.—Paving E. Main and S. Main st. in Wellington, to Lee & Greggs, of Millerburg, O., $35,000.

Palestine, O.—Paving various sts, to George Patterson, Wellsville, O., about $20,000.

Tiffin, O.—The following paving contracts have been awarded: LaBelle View blvd., to Floto Bros., $12,117; Church st., to John O. Bates, $464; Alley C, to same, $1,785; Railroad ave., to Floto Bros., $2,751.

Warren, O.—Constructing 5 mi. of brick highway, to the South Shore Construction Co., Erie, Pa., $80,000.

Franklin, Pa.—Constructing 13,178 ft. of brick rd., to J. E. Francis, Punxsutawney, Pa., $40,000.

Franklin, Pa.—Paving Liberty st., to the Northwestern Construction Co., Franklin, Pa., $1,768.

Johnsonburg, Pa.—Paving Center st., to Applegate & Co., $14,905.

McDonald, Pa.—Paving a number of sts, to Rosser & Maloney, Ballaire, O., $41,673.

McKeesport, Pa.—Constructing paving to cost $7,435, to Totley & Co.

Erie, Pa.—Paving 20th st., to J. & M. Doyle; paving E. Adams st., to Mayer Bros.

Newcastle, Pa.—Street improvement has been awarded to J. F. Summers & Son.

Pittsburg, Pa.—Paving Edwards alley, to J. B. Sheets Co., $2,159; constructing sidewalks, to E. L. Mahoney, $1,379.

Quakertown, Pa.—Macadamizing a number of streets, to Wm. P. Davis, of West Chester, Pa.

Reading, Pa.—Constructing vitrified pavement on Sixth st., to Fehr & O'Rourke, $13,166.

Dallas, Tex.—Paving Ross and Austin sts., to the Creosoted Wood Block Paving Company.

Salt Lake City, Utah.—Constructing sidewalks in extension No. 148, to McRae and Burt, $3,871.

Seattle, Wash.—Paving Lake View blvd., to P. J. McHugh, Third ave. and Mercer st., Seattle, $36,526.

Seattle, Wash.—The following paving contracts have been awarded: New 10th ave. grading, to Erickson Construction Co., Pioneer bldg., Seattle, $2,654; grading 63rd ave., southwest, to W. F. Manney & Co., $35,158.

Tacoma, Wash.—The following paving contracts have been awarded: Grading Madison, to Galluoi & Berost, Portland, $5,973; paving Gar and other sts., to Keasal Construction Co., Providence bldg., $59,471; paving alley, to O. R. Robinson Co., 1322 S. Young, Yakama ave., $1,125.

Wheeling, W. Va.—Repaving alley C, to George Lemmon; paving 21st st., to same.

Milwaukee, Wis.—The following paving contracts have been awarded: North ave., 22,581 sq. yds. asphalt, to R. F. Conway Co., of Chicago, Ill.; Greenfield ave. with asphalt, to the Badger Construction Co., 1015 Railway Exchange bldg., Milwaukee, Wis.; Greenfield ave. between 11th ave. and Layton blvd., to R. F. Conway Co., Chicago, Ill.

CONTEMPLATED WORK.

Phoenix, Ariz.—The city is contemplating the construction of 25,000 sq. yds. of asphalt pavement.

Argenta, Ark.—The city is contemplating paving in districts 11 and 12. E. A. Kingsley, Little Rock, Ark., engr.

Albany, Ga.—A $12,500 bond issue for street paving has been voted.

Morrison, Ill.—The city is contemplating the following paving construction: 16,170 sq. yds. asphalt macadam; 3,520 sq. yds. brick, 10468 lin. ft. combined curb and gutter; 2,000 lin. ft. of curb. Edw. O. Hills, cy. engr.

Ft. Wayne, Ind.—Frank M. Randall, cy. engr., has prepared plans and estimates for the paving of Webster st.

Shenandoah, Ia.—The city is contemplating the paving of 24,000 sq. yds. with asphaltic concrete.

Rockville, Md.—A $12,000 bond issue for the construction of roads has been voted.

Royal Oak, Mich.—A $40,000 bond issue for macadamizing Woodward ave. has been voted.

Binghamton, N. Y.—The paving of Main st. is contemplated.

Mt. Vernon, N. Y.—A $58,000 bond issue for road improvements has been voted.

Kings Mountain, N. C.—A $25,000 bond issue for the construction of roads has been voted.

Wilmington, N. C.—A $50,000 bond issue for road and bridge improvements has been voted.

Findlay, O.—The paving of Main st., to cost $40,000, is contemplated.

Checotah, Okla.—City council will adopt plans and specifications for extensive paving work, after which bids will be received.

Tulsa, Okla.—This city is contemplating the paving of 80 blocks of streets, to cost about $80,000. Cy. Engr. Hughes.

Pawhuska, Okla.—City council has passed resolutions for the paving of a number of streets with Oklahoma asphalt.

Hillsboro, Ore.—The city is contemplating the paving of 11 blocks with bitulithic, and the construction of sanitary and storm sewers.

Philadelphia, Pa.—The following street improvements are contemplated: Repaving sts. now occupied by car track, $500,000; improving blvd. from 2nd st. to Rhawn, $500,000; repaving various sts. with wood block, $300,000; grading st., $150,000; improving South Broad st., $150,000; resurfacing and improving country road, $100,000.

Washington, Pa.—A $500,000 bond issue for the construction of 21 mi. of brick highway has been voted.

Wellsboro, Pa.—A $49,000 bond issue for brick paving has been voted.

Granger, Texas.—A $100,000 bond issue for macadamized road construction has been voted.

Liberty, Tex.—A $250,000 bond issue for road improvement has been voted.

Dayton, Wash.—The city is contemplating the paving of Main st. and portions of other streets. J. A. Muirhad, mayor.

SEWERS.

BIDS REQUESTED.

Aurora, Ill.—July 1, 2 p. m. Constructing 4 mi. vitrified pipe in district 7 and 4 mi. in district 8. Lyons Parvel, engr.

Valley Junction, Ia.—July 13, 7 p. m. Constructing 5½ mi. 8-in. to 20-in. pipe sewers and a sewage disposal plant, two

checks for $500 each. Iowa Engineering Company, engrs., Chase blk., Clinton, Ia.

Parsons, Kan.—July 3. Constructing septic tank and sewer system to cost between $55,000 and $75,000. C. B. J. Wheat, cy. clk.

Louisville, Ky.—July 7, 12 m. Constructing 5,245 ft. 10 to 22-in. vitrified pipe sewer, certified check, 7 per cent. E. L. Atherton, chrmn. com. of sew. J. P. F. Breed, chief engr.

Fitchburg, Mass.—July 11, 3 p. m. Constructing 2,928 ft. of 45-in. concrete sewer; 490 sq. yds. brick masonry invert, certified check, $2,500. David A. Hartwell, chief engr.

Vicksburg, Miss.—July 3, 8 p. m. Constructing storm sewers on Grove st., Belmont st. and Levee st. J. J. Hayes, mayor.

Duquesne, Pa.—July 1, 12 m. Constructing sewer in Center st. L. W. Francis, chrmn. of sewer com.

Madison, S. D.—July 6, 8 p. m. Sewer construction as follows: 1,500 ft. 18-in. vitrified pipe; 3,000 ft. 18-in. vitrified pipe; 2,700 ft. 15-in. vitrified pipe; 6,060 ft. 12-in. vitrified pipe; 3,325 ft. 10-in. vitrified pipe; 11,520 lin. ft. 8-in. vitrified pipe; 3,360 ft. 6-in. vitrified pipe; 80 manholes; and 5 flush tanks, certified check, $1,000. Geo. W. Waskey, may. Wm. Rae, cy. audt.

CONTRACTS AWARDED.

Oakland, Cal.—Constructing sewer on Lyons ave., to Wm. Heafey, $11,348.

Brazil, Ind.—Constructing Pogue's Run sewer, 4,000 ft. in length, to Campbell & Crabb.

Tolleston, Ind.—Sonstructing sewer system, to Michael Byrne, Gary, Ind., $165,000.

Mullan, Idaho.—Constructing sewerage system, to R. M. Bartsen & Co., Butte, Mont., $15,760.

Clinton, Ia.—Constructing sewers in district No. 4, to W. Green & Son, of Appleton, Wis., $125,375. R. C. Hart, cy. engr.

Lexington, Ky.—Constructing sewers, to Joseph Melvin and Thomas O'Day.

Adams, Mass.—Constructing sewers, to J. E. Fitzgerald Co., of New London, Conn., $10,090.

St. Paul, Minn.—The following sewer contracts have been awarded: Eaton ave., to P. J. Ryan, $337; St. Clair st., to Christ Johnson, $1,486; Hathaway st., to A. Nelson, $1,210; Front st., to P. J. Ryan, $1,555; Jessie st., to O'Neil & Preston, $1,029.

St. Joseph, Mo.—Constructing sewers in district 72, to D. B. Kelley; in district 107, to John Marnell.

St. Joseph, Mo.—Constructing sewer in district No. 113, to E. F. Mignery.

Platte, Neb.—Constructing sewer in district A, to C. J. Burke & Son, of Kearney, Neb.

East Las Vegas, N. M.—Constructing sewer system, to Thomas McGovern and J. Ryan, Pueblo, Colo., $20,663.

Englewood, N. J.—Constructing sewerage disposal works, to the Atlantic Construction and Supply Co., Atlantic City, N. J., $16,227.

Syracuse, N. Y.—The following sewer contracts have been awarded: Colvin st. trunk sewer extension, to Patrick R. Reily, $61,703; Lancaster ave., to James Swift, $2,449; Livingston ave., to same, $1,2223; Sumner ave. to Philip Thomas, $1,294; Ackerman ave., to same, $4,066.

Bellefontaine, O.—Constructing sewerage disposal plant, to Theodore W. Hill, of Bellefontaine, $26,000.

Lorain, O.—Constructing complete sewer system, to United States Construction Co., Columbus, O., $17,869; constructing disposal plant, to Seymour-Rennick, Findlay, O., $7,523 for two bed plant and $9,991 for three bed plant.

Xenia, O.—Constructing sewerage plant in county institution, to Huonker & Williams, Springfield, O., $2,800.

Youngstown, O.—Constructing main trunk sewer, to John Grady, $40,000.

Arnold, Pa.—Constructing sewage disposal plant, to Tony Martin, of Tarentum, Pa., $50,000.

Erie, Pa.—Constructing sewers on 4 streets, to Clement Wolfran; constructing sewer on 1 street, to John McCormick & Son.

Newcastle, Pa.—Sewer construction has been awarded to the following contractors: F. M. Mayburk, Burns Bros. and Chas. Stapf.

Philadelphia, Pa.—The following sewer contracts have been awarded: Constructing inlets, to Wm. A. Ryan and Frederick Buckrus, $25,000; constructing bank sewers, to cost $175,000, to the following: Donati Delife, Joseph Perna, David McMahon, Vincent Jasolla, Joseph Conkling, Wm. A. Ryan, Emilie Pastuzzi, Patrick Durkin, Peter Ellis, Alphonso Perna, Joseph Lombardi, Richard Bennis, John A. Robb, Joseph Moss, Nicholas Cannol and John T. Connor.

Pittsburg, Pa.—The fololwing sewer contracts have been awarded: Forty-third st., to M. O'Herron Co., $1,752; Edwards alley, to J. B. Sheets Co., $713; the Lamasco drive, to Ott Bros., $448.

Sweetwater, Tenn.—Constructing complete sewerage system, to M. A. Joy, Terrell, Tex.

Seattle, Wash.—Constructing north trunk sewer in Interbay district, to Colson Construction Co., Alaska bldg., Seattle, Wash., $925,784.

Seattle, Wash.—The following sewer contracts have been awarded: N. 55th st., to Kroth and Jessen, 4011 Greenwood ave., Seattle, $13,381; N. 59th st. sewer, to same, $36,515.

Seattle, Wash.—Constructing sewers on 5th ave., to Nelson & Carlson.

Antigo, Wis.—Constructing sewerage disposal plant, to the John Borgan, of Green Bay, Wis., $90,945; constructing sewer, to same, $419,889.

CONTEMPLATED WORK.

Ozark, Ala.—A $15,000 bond issue for sewer construction has been voted.

Washington, D. C.—An American consul officer reports that a city in his district is contemplating the installation of a sewerage system. Address Bureau of Manufacturers, No. 6834.

St. Petersburg, Fla.—The city is contemplating the construction of a sewerage disposal plant. N. W. Spencer, cy. engr.

Albany, Ga.—A $12,500 bond issue for sewerage improvement has been voted.

Atlanta, Ga.—The J. B. McCrary Co., Empire bldg., Atlanta, Ga., has been retained to prepare plans for sewer improvement in the cities of Lavonia, Callatoosa and Winder, Ga.

Savannah, Ga.—John W. Howard is preparing plans for storm water drainage system extension.

Quincy, Ill.—The city is contemplating the construction of a sanitary sewer system in the south part of the city.

Valley Junction, Ia.—The city is contemplating the purchase of 7 mls. of sanitary sewers and a disposal plant to cost about $40,000. Iowa Engineering Co., Clinton, Ia., engrs.

Mulvane, Kans.—The city is contemplating the construction of a sewerage system to cost $6,000.

Morgan City, La.—K. A. Kramer, Magnolia, Miss., has been retained to make a survey for sewerage and water works system, to cost about $60,000.

Wymore, Neb.—C. H. Meeker is preparing plans and estimates for a complete sewer system for the city.

Albany, N. Y.—Rudolph Hering, 170

Broadway, New York, has been retained to prepare plans for proposed intercepting sewer.

Clinton, N. C.—A $30,000 bond issue for sewer and water works has been voted.

Bismark, N. D.—The city is contemplating the construction of a new sewer system.

Youngstown, O.—The city is contemplating the construction of a sewer in Rayen ave.

Edmond, Okla.—A $20,000 bond issue for the extension of water works system, sewers and improvement of the municipal electric light plant has been voted.

Oklahoma City, Okla.—The city is contemplating the construction of an electrolithic sewerage purification plant to dispose of the sewage from the Packingtown sewer, to cost about $25,000.

Tulsa, Okla.—City Engineer Hughes has presented plans and estimates for sewer improvements to cost $20,697.

Ligonier, Pa.—The city is contemplating the construction of a sewerage disposal plant and pumping station. F. H. Shaw, Lancaster, Pa., engr. Ira Brant, cy. clk.

Philadelphia, Pa.—A $50,000 bond issue for construction of Conockfink creek sewer and $160,000 for construction of main sewers has been voted.

Leola, S. D.—This city is contemplating the installation of a sewerage system to cost $4,043.

Knoxville, Tenn.—City council has rejected all bids on sewer extension work. New bids will be asked. Work is contemplated to cost $3,000.

Mount Pleasant, Tex.—A $16,000 bond issue for sewer improvements has been voted.

Ronceverte, W. Va.—A $16,000 bond issue for sewer improvements has been voted.

Mariette, Wis.—A $9,000 bond issue for sewer extension has been voted. J. L. Fisher, may.

WATER WORKS.

BIDS REQUESTED.

Macon, Ga.—July 16, 12 m. Furnishing and laying 5,000 ft. 12-in. pipe; 3,140 ft. 8-in. pipe; 5,363 ft. 6-in. pipe with all appurtenances, certified check, $500. John T. Moore, may.

Homewood, Cook Co., Ill.—July 1, 8 p. m. Furnishing a connected system of 6 to 10-in. cast iron water supply pipe, power hydrant, gate valve, valve boxes and specials, certified check, 10 per cent. Howard Harwood, sec. bd. of loc. imp. O. F. Reich, bor. atty.

Camden, N. J.—July 10, 11 a. m. Furnishing the following equipment for water works plant, power house, gasoline engine, with all connections, generator and complete electrical equipment. Samuel Wood, chrmn.

McAlester, Okla.—The city is advertising for bids on one Duplex pump and 40,000 ft. of 8-in. cast iron pipe for water works system.

Salt Lake City, Utah.—June 30, 8 p. m. Constructing waterways on various streets. H. G. McMillan, chrmn. bd. of pub. wks.

Seattle, Wash.—July 7, 10 a. m. Constructing steel pipe line for Cedar river water supply system No. 2, sertified check, 5 pe rcent. P. E. Bagley, sec. bd. of pub. wks.

Montreal, Can.—July 13, 12 m. Constructing final filters and appurtenances for city filtration plant, certified check, $65,000. L. N. Senecal, sec. bd. of com.

Brisbane, Queensland, Australia.—Jan. 30, 1912, 12 m. Furnishing the following water works supplies: 2 and 3 complete units, consisting of power generating plant or plants and pump or pumps of ample power and capacity to raise from the suction wells through the delivery mains through a total vertical lift of 400 ft. exclusive of the head due to friction, etc., not less than 6,000,000 British Imperial gal. of a volume each gal. of 277.463 cu. in. per unit plant per day of 24 hours. George Johnson, sec.

CONTRACTS AWARDED.

Colorado Springs, Colo.—Laying water mains, to J. S. Schwartz, of Colorado Springs; furnishing materials, to J. A. Clow & Sons, of Chicago, and Hendrie & Bolthoff, Denver, and the American Cast Iron Pipe Co., of Kansas City. C. B. McReynolds, water supt.

Marquette, Mich.—Constructing water works extension, to Wamless & Cling, Duluth, Minn., $60,000.

Kansas City, Mo.—Constructing a building for city hypochlorite plant at Quindaro, to Flanagan Bros., $7,100.

Glen Ridge, N. J.—The city has purchased the water works plant and all equipment of the Orange Water Co., $40,000

Sapulpa, Okla.—Constructing tank and 4 mi. pipe line for city water supply, to P. J. McNerney, Carthage, Mo., $120,000.

Sapulpa, Okla.—Constructing water works system to cost $230,000, to the Southwestern Engineering Co., Oklahoma City.

Willamina, Ore.—Constructing water works system complete, to Jacobsen-Bade, Portland, Ore.

Masontown, Pa.—Constructing filtration plant, to the Pitt Construction Co., Pittsburg, Pa.

Springdale, Pa.—Constructing 35,666 lineal ft. cast iron water pipe and 350,000 gallon reservoir, to McGlathery & Robb, Philadelphia, Pa., $17,993.

Seattle, Wash.—Constructing pen stock for Lake Union plant, to Jahn Construction Co., Empire bldg., Seattle, $31,489.

Milwaukee, Wis.—Extending high water service, to Edw. O'Donnell.

CONTEMPLATED WORK.

Oakdale, Cal.—An $82,000 bond issue for water works improvement has been voted.

East Peoria, Ill.—The city is contemplating the installation of a gravity water works system.

Moline, Ill.—The city is contemplating the erection of 350,000-gal. stand pipe. Grant Fair, chrmn. of com.

Augusta, Kan.—The city is contemplating the construction of a filtration plant to cost $4,000.

Coffeyville, Kan.—The city is contemplating water works improvements to cost $100,000, including filter plant and service main. Charles Stromquist, supt.

Morgan City, La.—K. A. Kramer, Magnolia, Miss., has been retained to make a survey for sewerage and water works system, to cost about $60,000.

Franklin, Mass.—A $50,000 bond issue for water works improvement has been voted.

Millard, Neb.—A $10,000 bond issue for water works improvements has been voted.

Charlestown, N. H.—The city is contemplating the construction of a small gravity water system for North Charlestown. Dudley & Sawyer, Lancaster, N. H., engrs.

New York, N. Y.—The aldermen have appropriated $8,690,000 for filtration plant at Jerome Park reservoir for Croton water supply.

Clinton, N. C.—A $30,000 bond issue for sewer and water works has been voted.

Old Harbor, O.—A $31,000 water works system is contemplated.

Van Wert, O.—A. L. Metheany, Lima, O., has been instructed to prepare plans and specifications for complete water works system.

Bennington, Okla.—City council has passed a resolution ordering that construction of a water works system to cost $20,000. The engineer has not been named.

Edmond, Okla.—A $20,000 bond issue for the extension of water works system, sewers and improvement of the municipal electric light plant has been voted.

Oklahoma City, Okla.—Local engineers are preparing plans for enlarging dams in the Canadian river for temporary water supply.

Marshfield, Ore.—The city is contemplating the construction of a joint water system with North Bend, Ore.

Glasgow, Pa.—The city is contemplating the construction of a water works system. Henry Camp, pres. coun.

Glen Rock, Pa.—The city is contemplating water works improvements. Jacob H. Brillhart, 34 N. 7th ave., Bethlehem, Pa., engr.

Huntington, Pa.—A new reservoir will be constructed by the Huntington water works company. Wm. Walker, pres.

Greenville, Tenn.—A $60,000 bond issue for water works and electric light improvement has been voted.

Price, Utah.—A $9,000 bond issue for water works extension has been voted.

Ellensburg, Wash.—Plans have been completed for the construction of water works system, including 16-in. pipe line and 1,000,000-gal, reservoir. E. M. Miller, engr.

Snohomish, Wash.—A $110,000 bond issue for the construction of a water works system has been voted.

BRIDGES.

BIDS REQUESTED.

Santa Barbara, Cal.—July 5. Constructing Thomas 3-hinge reinforced concrete bridge with 5-arch spans 126 ft. each. Estimated cost, $50,000. Frank Flourney, Santa Barbara Co., engr. Thomas & Post, Los Angeles, Cal., engrs.

Columbus, Ind.—July 5. Constructing several bridges. P. J. Sater, audt.

Bloomfield, Ind.—July 5, 2 p. m. Constructing bridge in Taylor twp. C. H. Jennings, audt.

Frankfort, Ind.—July 5, 2 p. m. Constructing 4 new bridges and repairing 12. C. M. Cromwell, audt.

LaPorte, Ind.—July 3, 10 a. m. Constructing several bridges. F. A. Hausheer, audt.

LaPorte, Ind.—July 6, 10 a. m. Constructing a number of bridges. Fred A. Hausheer, audt.

Richmond, Ind.—July 8, 11 a. m. Constructing 24-ft. span concrete bridge in Greene twp.; constructing 18-ft. concrete bridge on the Cart rd.; constructing concrete core and canal bridge. Demas S. Poe, audt. of Wayne co .

Rockville, Ind.—July 5, 1:30 p. m. Constructing several bridges. J. E. Elder, audt.

Mayersville, Miss.—July 3, 12 m. Constructing draw spans in all bridges in Issaquena co. M. M. Spiars, co. clk.

Friars Point, Miss.—July 3, 2 p. m. Constructing concrete or steel bridge. F. Parr, clk.

Vicksburg, Miss.—J uly 7, 12 m. Repairing Fisher's Ferry bridge. J. B. Laughlin, co. clk., Warren co.

Cincinnati, O.—July 7, 12 m. Constructing concrete bridge at intersection of German and Compton rds., certified check, $500. Fred Dreihs, pres. bd. of Hamilton co. com.

Cleveland, O.—July 12, 11 a. m. Constructing concrete bridge at North Woodland rd. John F. Goldenbogen, clk.

Harrisburg, Pa.—July 3, 12 m. Repairing two bridges, certified check, 10 per cent. B. F. Lebo, clk. co. com.

Houston, Tex.—July 3, 12 m. Constructing reinforced concrete viaduct over Houston ship canal, certified check, $20,000. D. Rice, may. W. L. Dormant, cy. engr.

CONTRACTS AWARDED.

Florence, Ala.—Constructing steel bridge over Elk river, to Austin Bros., Atlanta, Ga., $20,000.

Midvale, Ida.—Constructing steel bridge over Weimer river, to J. H. Forbes & Co., $11,495.

Goshen, Ind.—Constructing North Main st. bridge, to Elkhart Iron & Bridge Co., $5,277; constructing Lincoln avenue bridge, to Enrique Price, $1,150; constructing Wilden ave. and Northern Indiana ave. bridges, to Joseph Hess.

New York, N. Y.—Strengthening Williamsburg bridge, to Snare & Triest Co., $559,540.

Charlotte, N. C.—Constructing steel bridge over the Catawba river, to the Roanoke Bridge Co., of Roanoke, Va., $51,015.

Canton, O.—Constructing culvert, to John Wilson, of Alliance, O.

Hamilton, O.—Bridge contracts have been awarded to the following, all of Hamilton: John Golden, Joseph Westifer, George Emmons, Garver Contracting and Transfer Co., Jacoby & Lebaney Lumber Co., and J. T. Gullaume.

Hamilton, O.—Small bridge contracts have been awarded to the following, all of Hamilton: J. T. Guillaume, Horace Shield, Ohio Corrugated Culvert Co. and Geo. Emmons.

Middletown, O.—Contracts have been awarded as follows: Ohio Corrugated Culvert Co., $143; J. T. Guillune, $229; D. E. Snider, $9,081; Wm. Fogarty, $133; John Conrad, $124; J. T. Gillune, $174.

Oklahoma City, Okla.—Constructing 5 new bridges, to the Kansas City Bridge Co., Kansas City, Mo.

Scranton, Pa.—Constructing concrete bridge over Keyfer creek, to McLaughlin & Dingleberry, $995.

Ripley, Tenn.—Constructing 8 bridges, to the Joliet Bridge & Iron Co., of Joliet, Ill., $4,800.

Ft. Worth, Tex.—Constructing 60-ft. concrete bridge, to Dennis Sagan, $8,000.

Hallettsville, Tex.—Constructing bridge over South Mustang creek, to the Penn Bridge Co., Dallas, Tex., $1,030.

Richardson, Tex.—Constructing 70-ft. field span bridge, to the Missouri Valley Bridge & Iron Co., of Dallas, Tex.

Petersburg, Va.—Constructing bridge over Appomattox river, to the Virginia Bridge Co., Roanoke, Va.

Richmond, Va.—Constructing 118 ft. concrete bridge, to Owego Bridge Co., Owego,

CONTEMPLATED WORK.

New Haven, Conn.—Fredrick L. Olmstead, Boston, Mass., is preparing plans for a stone arch bridge at Edgewood Park to cost $7,000.

Indainapolis, Ind.—The city council has agreed to pay a sum not to exceed $10,000 to be added to the $70,000 appropriated by the county for the construction of the Capitol avenue bridge.

Michigan City, Ind.—The county is contemplating the construction of a 125-ft. bridge over Kankakee river to cost about $6,000.

Albert Lea, Minn.—The city is contemplating the construction of an 80-ft. concrete bridge to cost about $20,000. Wm. Barnuck, cy. engr.

New York, N. Y.—The construction of a

Red Lion, Pa.—The city is contemplatings templated.

the construction of a steel bridge on Charles st., over the tracks of the Maryland and Pennsylvania R. R.

STREET LIGHTING.

CONTRACTS AWARDED.

East Liverpool, O.—Furnishing complete electrical outfit for Oak Grove camp ground, to the Risinger Mfg. Co., 5th st., East Liverpool, O.

Bartlesville, Okla.—The Bartlesville Light & Power Co. has been sold to Ira L. Kobe, of Chicago, Ill.

Lancaster, Pa.—Lighting city for period of 5 years, to Edison Electric Light Co., at $65.75 per light per year.

Walla Walla, Wash.—The City Power and Light Co. has purchased the plant of the Waitsburg Electric Light Co., Walla Walla, $45,000.

CONTEMPLATED WORK.

Headland, Ala.—A $7,500 bond issue for the electric light extensions has been voted.

Albany, Ga.—A $50,000 bond issue for a municipal gas plant has been voted.

Blackshear, Ga.—The city is contemplating the purchase of a municipal light plant.

Hope, Idaho.—A franchise has been granted to the Northern Idaho & Montana Power Co. for lighting sts.

Fort Wayne, Ind.—The city is contemplating the installation of the ornamental street lighting system on several streets.

Dallas Center, Ia.—The city is contemplating the construction of an electric light plant.

Kansas City, Kans.—City has sold $35,000 bonds for municipal electric light plant to the Commerce Trust Co.

Boston, Mass.—The city council has appropriated $300,000 for the purchase of gas street lamps with automatic devices for lighting.

Billings, Mont.—The installation of ornamental lighting system is contemplated.

Rockville Center, L. I., N. Y.—An $11,000 bond issue for the construction of an electric lighting plant has been voted. S. G. Hooley, vil. atty.

Elmore, O.—A $5,000 bond issue for electric lighting system has been voted.

Edmond, Okla.—A $20,000 bond issue for the extension of water works system, sewers and improvement of municipal electric light plant has been voted.

Shawnee, Okla.—The plant of the Shawnee Gas & Electric Co. has been destroyed by fire. H. M. Bylesby & Co., of Chicago, Ill., will rebuild soon.

Oakland, Ore.—A $15,000 bond issue for the construction of light and power plant has been voted.

Beaver Falls, Pa.—The merchants on 7th ave. have decided to install ornamental lighting system.

Pittsburg, Pa.—The city is contemplating the extension of the ornamental lighting system to the following streets: Penn ave., 5th ave., Wood st. and Smithfield st. Joseph D. Armstrong, dir. of pub. safety.

Edgefield, S. C.—A $15,000 bond issue for an electric lighting system has been voted.

Greenville, Tenn.—A $60,000 bond issue for water works and electric light improvement has been voted.

Moosejaw, Sask., Can.—The city is contemplating the construction of a $35,000 lighting system, and ornamental lights to cost $7,500.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Erie, Pa.—July 3. Constructing garbage incinerator plane for the city of Erie, certified check, 10 per cent. B. F. Briggs, cy. engr.

CONTEMPLATED WORK.

Boston, Mass.—All bids for disposal of city garbage have been rejected and new proposals will be asked.

Passaic, N. J.—The city is contemplating the construction of a complete garbage disposal plant. J. F. Featherstone, New York, engr.

Paterson, N. J.—This city is contemplating the construction of a garbage disposal plant to cost about $60,000. William F. Morse, New York City, engr.

Oklahoma City, Okla.—The city is contemplating the construction of a garbage disposal plant. Address, J. P. Highley, com. of pub. safety.

Newcastle, Pa.—The city is contemplating the enlargement of the garbage disposal plant. Address, Councilman Raney.

St. Johns, N. B., Can.—The city is contemplating the construction of a garbage disposal plant to cost about $50,000. Wm. Murdock, engr.

FIRE APPARATUS.

CONTEMPLATED WORK.

Little Rock, Ark.—The city is contemplating the purchase of an auto combination hose wagon; a first sized fire engine; a chief's auto; and a 75 ft. quick raising aerial truck.

Washington, D. C.—An American consul in Canada reports that a town in his district desires information and prices on a combination hose and ladder truck, auto propelled. Address Bureau of Manufacturers 6879.

Miami, Fla.—The city is contemplating the purchase of an auto truck.

Evanston, Ill.—The purchase of a motor fire engine with chemical tank is contemplated.

Decatur, Ind.—The city is contemplating the erection of a city hall and fire department building to be equipped with automobile apparatus.

Pikesville, Md.—Thr city is contemplating the purchase of an auto truck. Jacob H. Trask.

Lawrence, Mass.—The city is contemplating the purchase of an auto combination fire wagon.

Springfield, Mass.—City is contemplating the purchase of an auto squad wagon. J. B. Cadle.

Springfield, Mo.—Chief McLaughlin has recommended the purchase of 2 auto-propelled chemical engines.

Butte, Mont.—The city is contemplating the purchase of an auto and an aerial truck. Peter Sanger, chief.

Morristown, N. J.—The city is contemplating the purchase of an auto fire truck to cost about $6,000.

Niagara Falls, N. Y.—The city has voted $42,000 for the purchase of two fire houses and three pieces of automobile apparatus. David Isaacs, fire comr.

Yonkers, N. Y.—The ctiy is contemplating the purchase of three automobiles for fire department, to cost about $1,500.

Baker, Ore.—The city is contemplating the purchase of an auto-propelled fire engine. D. L. Palmer, mayor.

Providence, R. I.—The city is contemplating the purchase of 4 motor-driven combination wagons for the fire department, to cost about $20,000.

Clinton, S. C.—The city is contemplating the purchase of additional fire equipment. Address J. W. Cooper, chf.

Montpelier, Vt.—The city is contemplating the purchase of an auto propelled chemical engine.

Norfolk, Va.—This city is contemplating the purchase of motor fire equipment.

MUNICIPAL ENGINEERING

VOLUME XLI NUMBER TWO

AUGUST, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

ITEMIZED QUANTITY ESTIMATES.

CAREFULNESS and methodical attention to detail are much more important in taking off quantities than in setting the price for the individual kinds of work.

The quantities for any one job in their various proportions exist for that job alone and there is nothing to guide judgment or mental checking on the basis of past experience. The quantities of the different kinds of work when set forth on an estimate sheet must be accepted as correct, but they possess this desirability just so far as the estimate has been carefully prepared by a competent estimator. The majority of estimators have their own peculiar ideas as to the manner in which the work is taken off, the form in which notes are made and preserved in the working up of the final; generally, it will be found that such notes, even when preserved in an estimating book, will be so obscure that it is almost impossible for any other man to check the results.

As mentioned before, the checking of the cost estimate is much more certain and mistakes can be discovered for the reason that all branches of work have certain unit prices, varying between usual limits. Any seeming inconsistency is at once apparent to the eye and can be investigated and either confirmed or revised.

We must, therefore, establish some system and method of recording the quantities as they are taken off, part by part, in order that we may have the opportunity of independently checking and preserving the notes in complete detail. This is preferably done by such a blank form as is shown in Plate VI. If a form of this kind is used we secure all these advantages and in addition we have on file a complete statement of the job so itemized and in such form that should the job be secured no changes can be made in any of the working plans over the preliminary plans on which the work is based. In cases where preliminary plans are returned, with possibly a delay before awarding of the contract, and then working plans furnished, it is well to at once check off on the itemized quantity estimate the quantities as shown by the working plan. Many times, the preliminary plans are not made complete in all details, with the result that when the working plans are prepared and all details worked out revisions and changes will be necessary in the general plans. If, as is usual, the preliminary plans have been returned, the only record remaining in the hands of the contractor is this itemized quantity estimate.

Right here, it may be well to lay all the stress possible upon the fact that any contractor receiving a set of plans and specifications should at once mark on each sheet of the plan the date and his name in ink, so that in case the work should be awarded him he may call for the exact set of plans and specifications which were in his possession at the time of making his proposition. This is not advocated because we must be suspicious of dishonesty or manipulation, but it is a fact that in the preparation of various sets of plans and specifications there is always the opportunity for typographical errors, failure to bind in all sheets, omission of details and failure to make revisions and corrections on some of the sets. Also, many times as revisions are made (and especially where the letting of the work is delayed from time to time, due to such revisions and receipt of additional proposals) there is accumulated a multiplicity of blue prints, etc., which are out of date. Now, if these sheets are preserved they are a menace to the contractor, as they may, through error, not be replaced with the new sheets. On the other hand, if they

are destroyed there is nothing with which to compare the revision, as the architect or engineer in nearly all work makes his revisions by erasures and additions to the original tracings, and, therefore, the tracings themselves bear no adequate means of identifying the original drawing.

These same conditions apply during the entire construction of the work, and generally the first plans are called in and the new plans substituted. The writer knows of one case on a large and important piece of work where the architect made a rule that no revised plan would be issued until the first plan had been returned and destroyed, and from this rule there could be no deviation. It was found that the first set of plans was deficient in many details and as a result the quantity of work was largely increased. The method adopted by this architect, whether prompted by proper motives or not, had the effect of covering up the mistakes and discrepancies in his original plans. As the work was complicated and constantly changing in size of members, etc., the contractor was placed in the position of unwittingly doing more work than he had really contracted to do.

The itemized quantity estimate, as proposed in Plate VI, is the result of a personal experience in errors in quantity estimating and in loss due to just such conditions as were last mentioned. It is for the purpose of providing as far as possible against future errors that this form has been developed. It has been used and it has been demonstrated that with proper care a reasonable amount of certainty may be expected. This quantity estimate when prepared in the manner suggested is also of great value when the time comes to submit a schedule of quantities and prices for the preparation of the monthly estimates and naturally forms the basis of the preparation of the amount of each class of work for each month's estimate and by this system the preparation of estimates is simplified and made so systematic that the estimates will form a definite series tied together, so that at all times by it is shown exactly what amount of work has been accomplished and what percentage of the work completed.

It will be noted that the itemized quantity estimate bears for all practical purposes the same style of heading as that previously given for "Outline of Work," Plates II and II. By carrying through this general heading and the same estimate number, all of the estimates, plans and papers are preserved in their proper place.

It is expected in using this blank form that each calculation forming a part of the determination of quantities shall be set forth under each item of work. This being the case, and as there generally will be several calculations for each kind of work, the latter will show very prominently in the first column and there is very little opportunity of anything being overlooked.

The next two columns, bearing as they do a reference to plans and specifications, furnish a very ready index with practically no extra labor to the estimator.

The next column is important. The location of that portion of each kind of work under process of calculation should certainly be noted. If this is done, how much easier it is to check the quantities at any time and how much more definite the estimate and connection of the quantity estimate with the proposed work.

The next column furnishes all the necessary dimensions for the determining of any kind of work entering into the job when used with the unit columns for the various classes of work entering into the item of principal work. It might be well, here, to bring out the point that the classification of work as called for by plans and specifications is much less complete than the classifications of different items of work which must be estimated by the contractor, and yet the contractor must retain the specified classifications, either for unit price bidding or for submission of schedules in lump sum bidding, or percentage contracts.

The itemized quantity estimate, Form Plate VI, is so arranged that the various divisions desired and required by the contractor are separated by the columns at the right hand side of the sheet. These columns provide for a unit and a total, the unit column being intended for the usual multiplier or divisor in order to place within the total column the quantity as based upon the dimensions. The headings for these columns are to be written in according to the practice of the individual contractor and opposite each main item of work.

Referring to Plate VI, various illustrations are given of the manner in which main items of work may show their location, part by part, giving the dimensions of such portions, and then immediately following are given the separations or secondary classifications into which the main items must be divided in order to make an intelligent estimate. In presenting these illustrations no attempt has been made to illustrate the application to any particular kind of job, but, instead, various kinds of work are shown which in all probability are likely to occur in any kind of construction.

The use of this blank can be made universal, but the individual application must depend upon the contractor's line of work

CONTRACTING PRACTICE — PLATE VI

A-B-C CONST'R CO.

ITEMIZED QUANTITY ESTIMATE

NATURE OF WORK: Illustration of Use of this Form

WHERE LOCATED: _____

OWNER _____ ARCH OR ENGR. _____

EST. NO	41
SHEET NO	1
DATE	7/10/11
ESTIMATED BY	JS
EXTENDED BY	M.V.L.
RECAPITULATED BY	JS
CHECKED BY	O.V.M.
REVISION SEE SHEET	

GROUP ITEMS WITH BRACKETS		ITEM OF WORK	LOCATION	SHEET PLANS	PAGE SPEC.	DIMENSIONS LENGTH	WIDTH OR HEIGHT	THICKNESS OR DEPTH	NO. OF PIECES	QUANTITIES BY UNITS & TOTALS — WRITE IN PROPER HEADING FOR EACH ITEM OF WORK: UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL	UNIT	TOTAL
Basement	1										Bldg Excav		Bldg Excav		Bldg Backfill		Bldg Filling		Gravel
	2	Excav	Main Bldg	1	4	100	54	10		27	7000					3	97200	1/2	1000
	3		Alley Wing	1	4	54	27	12		27	648					3	4860	1/2	324
	4		Annex	2	15	400	3	15				27	666					27	30000		
	5	Total									7648		666		14100		97200		1324
	6	Concrete									Concrete		Found		Ret Bldg		Basement Floors		
	7	1:3:6	Main Bldg	2	6	308	12	Ave 1½		27	205	3	11089		Masonry				
	8		Wing "	2	6	135	14	" 1½		27	105	3	5670						
	9		Boiler House	2	7	127	54	4"		27	85			8	680	1/2	428		
	10	Total									396		16758		680		428		
	11	Concrete									Concrete		Forms		Cornice		Steel		Steel Reinf
	12	1:2:4	Columns	3	8/9	10	1½	1½	24	27	20	21	5040			6	1440		
	13		Girders	3	9	27	1¼	2½	16	27	50	16	6048			10	4320		
	14		Roof	3	9/10	127	54	4"		27	85			4	27482	1/2	7308		68.6
	15		etc etc																
	16	Total									155		11085		27482		13068		68.6
	17																		
	18										Brick Common		Face		Face		Face		
	19	Brick	St Front	4	11/5	54	15	18"		15	12150	16	8730	7	5670				
	20		Side walls	3/6	"	173	15	13		22	57090	"	62810						
	21		Alley Wall	7	"	108	10	13"		22	23760	"	17820						
	22		Wing Side	5	"	81	10	8"		15	12150	"	9720						
	23		Partitions	8	"	27	8	8"		15	3240		2430						
	24		Stacks	8	16	40	3 Ave	8?4"		15	7200		5400			7	3360		
	25		etc																
	26		etc																
	27	Total																	
	28																		
	29																		
	30	Steel								#	12"I		10"I		6"I		6x4L		C.I.Cols
	31	Steel	1st Floor	6	15	14			32	10	17920								
	32		2nd "	6	15	14			32			32	14336						
	33		1st floor	"	"	10			64					18	11520				
	34		2nd "	"	"	10			64					13	8320				
	35		Roof	"	"	14			32			32	14336						
	36		"	"	"	10			32					13	8160				
	37		1st Floor	"	"	14			64							3	11021		
	38		2nd "	"	"	"			"							"	11021		
	39		1st "	6	16	10	6"	7/8	24									44	10560
	40		2nd "	6	16	10	6"	½	20									27	6480
	41		etc etc																
	42	Total																	
	43																		
	44	Painting									1/2		1/8		1/2		1/4		1/16 1/2
	45	Steel	Columns 1st	3	8/9	12	8/1		1x24	13	1728								
	46		" Heating	"	"	50			24									3	100
	47		Beams	3	9	27	4-8/5		4x16 4x20	15	2682	10	1728						
	48		Floors	3	10	30		6"	860					2/3	11466				
	49		Roofs	"	"	20		6"	860							11	2872		
	50		etc																
	51		etc																
	52	Total																	
	53	Windows									6x12		4x8		3'7		1'6		12x12
	54		Cols 1st	3	8	10			24									12	2880
	55		1st Girt	"	"	14			32	6	2688								
	56		1st Roof	"	"	10			64			27	1728						
	57		1st floor			100	54							2/3	18440	1/4	2025		
	58		etc etc																
	59	Total																	

PLATE VI. CONTRACTING PRACTICE.
Itemized Quantity Estimate.

and his individual ideas as to separation into component parts, the latter naturally depending upon the manner in which he keeps his cost record. The advantage of the form lies in the fact that instead of taking off different parts of each main item separately and repeating over and over again the given dimensions, the main item and dimensions are only given once and the other quantities are arrived at by the use of their proper units.

Referring again to Plate VI, and taking excavation: In any piece of work it will be necessary to state several dimensions in order to cover the shape of the excavation and varying depths. The quantities should be, of course, in cubic yards; therefore, the unit column carries the divisor 27. In excavation, however, it is generally the case that shoring or sheeting of the banks is necessary and the amount of such work is directly dependent upon the same dimensions, being the perimeter of the excavation times the height; therefore, the unit column under this heading provides the average thickness of all timber required, in inches, which gives the quantity in thousands of feet board measure. In case the excavation is of such a character that it may be expected to uncover gravel, which may be used in the construction, and it having been determined by test digging the depth at which it can be obtained, we find in the unit column "one-half" or any other proportion. Inasmuch as in any large job several detail calculations such as this are necessary in order to arrive at the grand total, we have each portion grouped by the use of this method so that each kind of work is stated exactly in proper relation to the work as a whole. If any item shows no such divisions it is at once apparent and investigation can be made to ascertain whether same was overlooked. This method also allows of a more intelligent pricing of the work, as the more complicated portions are automatically emphasized and may be priced accordingly, whereas, by any other method it is more than probable that averages would be taken over the entire work.

The same conditions apply to concrete, but to even a greater extent. Concrete as a main heading will in general be divided into main items of work where the proportions of the concrete mixture are varied and the location and dimensions of the work where any one mixture is to be used are grouped. We then have the unit item under concrete containing a divisor 27, as we wish our concrete quantity in cubic yards. The amount of forms required is directly dependent upon the square feet of surface area which are given by main dimensions. In the unit column is placed a multiplier giving the inches in thickness of the lumber necessary to form the facing, studding, braces, etc., all of which can be quickly calculated, and, really, after some experience, becomes a standard for various classes of work, the result is to give us our quantities of forms in thousands of feet board measure.

The method applies to centers the same as for forms, and the resulting quantities are in thousands of feet board measure, except that a separate item is necessary to list the amount of piling necessary in case of false work for bridge construction.

In building construction the reinforcing steel for various designs can be obtained from tables on a basis of unit pounds per square foot of floor and lineal foot of beams and columns, and these units should be placed in the unit column opposite the listing by dimensions and pieces of the various portions of the structure.

If there is more than one kind of steel there must, necessarily, be more than one column used for itemizing, on account of the difference in prices. If the structure is a steel one entirely or is a large reinforced concrete job with a complication in the size of bars and kinds of reinforcing or made up of standard structural shapes, then steel should be made a general item of work, and these unit columns become the proper method of the separation of the steel bars and shapes into their proper classification for standard prices and standard plus extras. In a complicated case of this kind with many divisions all that is necessary in case more columns are required than are provided by the standard sheet is to cut from other sheets and paste as many columns as are necessary on the right hand side. These columns can then be folded in without interfering in any way with standard procedure. Many other columns are at once apparent for separation for concrete work. For instance, waterproofing, if incorporated in the mass, is an element of the cubic yardage and should be listed opposite that portion of the work where same is required. If waterproofing is in the nature of the sheet method or surface application, it naturally depends upon the square feet of surface covered, which is shown by the dimensions of that part of the work where same is required. The unit column for waterproofing would, therefore, show unit pounds of compound per cubic yard or thickness in fractions of a foot to give results in cubic feet.

The same conditions apply to cement finish, filling under-work or over-work wood floors, marble floors, painting, plastering, etc., as all these items of work will appear opposite the portion of work where they are to be used, and as the dimensions of such parts of the work are clearly stated it is only necessary to place in the unit column proper unit mul-

DATA:- Building 53×100 — 2 Sup. Floors & roof — Gen. Sk.-Long Span Tile Constr. — Sq. ft. ___ per sq. ft. — Cu. ft. ___ per cu. ft.

A-B-C CONST'R CO.

ITEMIZED COST ESTIMATE

Smith Mfg. Co. — FOR WHOM
General Contract — WORK INCLUDED IN EST
Metropolis — WHERE LOCATED
R. Concrete Bldg. — NATURE OF WORK

ESTIMATE NO. 25
SHEET NO 1
DATE 7-9-11
DESIGNED BY A.F.B.
QUANTITIES BY W.L.
EST. PRICED BY J.W.M.

	1 Principal Item	2 Quantity: Amt. From Itemized Quan. Est	2 Quantity: Unit	3 Unit Items Composing Principal Item: Item	3 Unit Items Composing Principal Item: Quotations on Material	3 Unit Items Composing Principal Item: Quan	3 Unit Items Composing Principal Item: Price	6 Resulting Unit Prices Principal Item: Mat.	6 Resulting Unit Prices Principal Item: Lab	7 Total Cost of Material Col. 5 × 2	8 Total Cost of Labor Col. 5 × 2	9 Total Cost Mat. & Labor	10 Remarks
1	Excavation	510	Yds	Labor		510	75		.60		306		Dump 1 mile
2													
3	Filling	1000	Yds	Cinders	Per Car of	25 yds	50	.20		200			Belt R.R.
4				Labor					.60		600		
5	Forms	114	M	Labor					2700		3078		Union Lab.
6	Centers	120	M	Labor					1700		2040		" "
7	Total F&C.	234	M	Lumber		1/30 1½	26	12.50		2925			Salvage consid.
8	Concrete	1650	Yds	Gravel	On Dock 65¢	9/10	1.00	.90		1485			B.R.S&G.Co
9	(1:2:4)			Sand	" " "	45/100	1.00	.45		743			" "
10				Cement	A.P.C. Co	1 4/10	1.10	1.55		2557			
11				Water	Water Co.			.10		165			
12				Labor					1.75		2888		
13	S.P. Tile 6"	9500	Sq. Ft.	Tile	B.C. Co.	F.o.b.	05	.05		475			
14	10"	18900	"	Tile	B.C. Co.	F.o.b	07	.07		1323			
15	Total	28400		Labor		"			.01½		426		
16	Reinforcement	3 2/10	Tons	¼" Sqs.	S.T. Co.	F.o.b.		45.00		146			
17		4/10	"	3/8" "	S.T. Co.	F.o.b.		43.00		17			
18		3/10	"	½" "	S.T. Co.	F.o.b.		40.00		12			
19		3 6/10	"	5/8 "	S.T. Co	F.o.b.		39.00		140			Average 2 7/8 to 10 lbs. ft.
20		5	"	¾" "	S.T. Co.	F.o.b.		38.00		190			
21		48	"	¼ & ¾	F.B. Co	F.o.b.		63.00		3024			Fabricated
22		20	"	1"	F.B. Co.	F.o.b.		58.00		1160			" "
23	Total	80 55/100	"	Labor		Ave.			10.00		805		
24	Exp. Metal	2000	Sq. Ft.		S.T. Co.	F.o.b.		.04		80			
25	Total			M.&L.						14642	10143		
26	Gen. Chg.			All Items					20%		2028		
27	Total			Cost								26813	
28	Profit					15%						4022	
29	Bid			Lump	Sum							$30835	
30													
31													
32	For Unit Price Bid on Concrete see Estimate below :-												
33													
34	Concrete	1650	Yds	Gravel		9/10	1.00	.90		1485			Unit Price
35	1650 yds.	1650	"	Sand		45/100	1.00	.45		743			based on
36		1650	"	Cement	A.P.C. Co.	1 4/10	1.10	1.55		2557			Concrete as
37		1650	"	Water				.10		165			additional
38		114	M	Forms	Use 1½ time	69 B.M.	12.50	.86		1419			stories may
39		120	M.	Centers	" " "	73 B.M.	12.50	.91		1502			be added of
40		9500	Sq. Ft.	Tile 6"	f.o.b.	5344 Ft.	.05	.29		475			same type
41		18900	Sq. Ft.	Tile 10"	f.o.b.	11½ 30 Ft.	.07	.80		1323			
42		80 55/100	Tons	Reinforcement		97 6/10	2.50	2.83		4689			See Itemization
43				Labor		Con.			1.75		2888		
44		114	M.	Labor		Forms	27.00		1.86		3078		
45		120	M	Labor		Centers	17.00		1.24		2040		
46		28400	Sq. Ft.	Labor		Tile	.01½		.26		426		
47		80 53/100	Tons	Labor		Reinf.	10.00		4.9		805		
48	Total			M.&L.				8.69	5.60	14358	9237		
49	Gen. Chg.			All Items		20%			1.12		1847		
50	Total			Cost				15	41			25442	
51	Profit					15%		2	31			3816	
52	Bid			Per Cu. Yd. Concrete				$17	72			29258	
53													
54													
55													
56													
57													
58	See Sheets 2, 3, 4 and 5												
59													

PLATE VII CONTRACTING PRACTICE.
Itemized Cost Estimate.

tipliers or divisors to secure the results in the desired quantity basis. This unit is naturally preserved along with the other complete data, and in case it is desired, for instance, to ascertain the additional cost, provided the cement finish in certain portions of the work is changed from ½-inch in thickness to ¾-inch, the information is obtainable almost instantly; whereas, if this method had not been followed it would be necessary to refigure the plans.

Timber and lumber can be taken off in the same manner, using the columns for the different sizes of timber at the various prices, and using the unit column for unit feet board measure. If the structure is a large one and many sized pieces are called for, all that is necessary is to provide additional columns, as is mentioned above under steel.

Brick work is peculiarly adaptable to this method of estimating. The various portions of the work are stated in the location column and the dimensions given; we then use our secondary columns to obtain the quantities of common brick, face brick, special brick, and in each case the separation is made directly opposite the respective locations, but the total is reached just as surely. The opportunity is also afforded for the statement in parallel columns of the amount of brick "Wall Measure" and "Kiln Count."

Remember that this should be an axiom for the contractor, that any estimate must be made by detail calculations. If such detail calculations are recorded as provided for by our form the totals are obtained readily; but a lump sum quantity estimate obtained from scratch pad calculations can never be separated without recalculation and uncertainty.

Illustrations could be carried on *ad libitum*, but the illustrations given are of sufficient extent to show the wide application of the method suggested, and it only remains for a few moments' thought to so arrange the form that same can be used for any class of work.

The extreme left hand column—"Group Items With Brackets"—makes doubly sure the obtaining of correct totals and adds materially to the clearness of the estimate. If, for instance, we have in the "Item of Work" column the heading "Concrete" and then follow on down the sheet with numerous items filling out the right hand columns, then by the addition of a bracket inclosing these items down to the total, the eye is enabled at a glance to read these results without confusion.

The advantage of this form of detail quantity sheet is not limited to the estimate, for in case the contract is secured it is relied upon for the ordering of material and the order in which same is to be delivered, all because each class of work is given by location, the unit applying to such work, and the quantity required for each portion. In any lump sum estimate this information could not be obtained without recalculation.

The quantity sheet also works in directly with the methods of cost analysis and the office and field system connected therewith. And above all, it is of importance in the division by sections and the recognition of same during the period of construction and analysis.

In taking off the quantities from the plans use common white crayon to check each item and each portion of the work as the quantity estimate is tabulated. When the estimate is completed and the plans are to be returned to the architect or engineer, or forwarded to a competitor, wash the prints with a soft rag soaked in gasoline and all defacement will be removed.

For the purposes of the preparation of the itemized quantity estimate where many extensions are required, some form of a non-listing calculating machine is almost indispensable. Such a machine insures accuracy and saves time and extra help, and because of its speed an estimate can be prepared and checked during preparation and delivered in a fraction of the time required by ordinary method. The cost of such a machine is not excessive and it is well adapted for all forms of work in a small office. In the larger office there should be an addition—a listing adding machine—in order to check the securing of totals.

The slide rule should not be used in estimating of quantities or in multiplications and extensions. It is not the author's idea to under-rate the slide rule, but in the contractor's practice it will serve a far better purpose in cost analysis, and for these purposes it is indispensable, if time is any object.

Itemized Cost Estimates.

Passing to the "Itemized Cost Estimate," which is directly dependent on the "Itemized Quantity Estimate" and the next and final step in the Estimate Department, we propose the forms shown in Plates VII and VIII.

Plate VII is to be used where all the work contemplated is to be performed by the contractor's own organization and where as a result it is necessary to enter into full detail as to the costs of each and every item of work.

Plate VIII is to be used for the tabulation of those portions of the work where the contractor accepts sub-bids in lieu of making his own estimates or in addition thereto.

The headings of these forms are practically the same as for the "Itemized Quantity Estimate," except that the estimate is made more definite by stating

DATA:-	Cost per sq. ft.	per Cu. ft.
Excav. etc.		
R. Con. etc.		
Mill Work etc.		
Painting etc.		
etc. etc.		

A-B-C CONST'R CO.

Smith Mfg. Co. — For Whom
Metropolis — Where Located
General Contract — Work Included in Est
R. Concrete Bldg. — Nature of Work

ESTIMATE No.	25
SHEET No.	4
DATE	7-9-11
DESIGNED BY	FHB
QUANTITIES BY	W.Y.L.
EST. PRICED BY	DMI.

	Principal Item	A-B-C-Co's, Est Quantity Amt	Unit	Unit Price	Total	Name of Sub Bidders	Sub Bids	Selected Sub Bids for Est of Cost	Unit Price Sub Bids	Remarks
1	Cement	5750	sq. ft.	11¢	633	Block Mfg. Co.	690	690	12¢	
2	Blocks.					John. Smith	725		12 6/10 ¢	
3						Cement Block Co.	745		13¢	
4										
5	Cement	1150	lin ft.	25	288	Block Mfg. Co.	345	345	30¢	
6	Sills					John Smith	360		31 3/10 ¢	
7						Cement Block Co.	375		32 6/10 ¢	
8										
9	Cement									
10	Coping	525	lin ft.	25	131	Block Mfg Co.	258		49¢	
11						John Smith	240		45 3/4 ¢	
12						Cement Block Co.	225		43	
13						Use Co. Est.		131		
14										
15	Mill Work.				2000	Metropolis Lum. Co.	2120			See
16						Jones & Brown.	1600			Detail
17						Doe-Roe Co.	1860	1860		Est.
18										
19	Wood Sub.	70	M.	40.00	2800	1. Metropolis Lum Co.	3500		50.00	Laid
20	Floor					2. Jones & Brown.	2450		35.00	Mat. f.o.b.
21						3. Doe-Roe Co.	3000		42.80	Laid but Cug. in Spec.
22						Use average 1 & 3		3250		
23										
24	Maple									
25	Floor	50	M.	40.00	2000	1. Metropolis Lum. Co.	2100		42.00	Laid
26						2. Jones & Brown.	1500		30.00	Mat. f.o.b.
27						3 Doe-Roe Co.	2000	2000	40.00	Laid
28										
29	Sheet				No. Est.	Sheet Metal Co.	600	600		
30	Metal					Cornice Works	675			
31										
32	Painting	2000	[illegible]	.50	1000	H. J. McMicheals	980			?
33	Glazing & Oil.					C. I. Dunlop	1020	1020		
34						Compton & Baker	1200			
35										
36	Fire Doors	20. 1000	sq. ft.	1.00	1000	Fire Door Co.	923	923		Installed
37						X Hardware Co.	923			
38										
39	Etc									
40										
41	Etc									
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
	Carried	forwarded	to			Sheet No. 5.	C 6750 / 3			

PLATE VIII. CONTRACTING PRACTICE.
Sub-Contractors' Bids.

"for whom" the bid is prepared and the "work included in estimate." This is good information, especially if only a portion of the work is included and figures are made for general contractors. Perhaps the same work may be the subject of two or more estimates as a preliminary one to the owner or architect and a final to the same or to general contractors and the notation explains any discrepancies.

Referring to Plate VII, columns 1 and 2 are taken directly from the "Itemized Quantity Estimate" recapitulation of totals. These principal items are now dissected to analyze the cost which in all cases demands the separation of material and labor and also, generally, will require several items for materials which go to make up the principal item. Also, many times the labor must be separated into the different operations entering into the complete handling of the materials. Columns 3, 4 and 5 are used for this dissection by first stating the items, then any quotations received, then the quantity and price of sufficient of the secondary materials and labor to form one unit quantity of the principal item. The result is Column 6, the resulting unit price per unit of quantity as given in Column 2. Columns 7 and 8 give the totals for materials and labor and should be totaled separately before carrying to the "Total Cost Material & Labor," unless, for some reason, it is necessary to separate the work into sections, when, naturally, intermediate grand totals are given.

The labor column must, however, be footed independently and for the complete work in order to provide for "General Charges," as will be explained later.

This estimate is just as adaptable for unit price bids as for lump sum bids, the only difference being that for lump sums the total of Column 9 is used, whereas for Unit Bids the various totals in Column 6 for items Column 1 are used with the General Charges and profits added to each unit price for each item as the Estimate proceeds, and totals extended to Columns 7, 8 and 9.

In the latter case, the contractor not only has a tabulated record of his bid prices, but also his estimated quantities and the amount of materials, labor and total.

Each and every class of work to be performed by the contractor should be treated as a principal item, regardless of the classification of the specifications. For instance, forms for concrete should be given in feet board measure and not added as a guess amount per cubic yard of concrete, as is too often done.

Consider that a wall 12 inches thick requires practically just as much form work as a wall 27 feet thick or 54 square feet of surface per cubic yard as against 2 square feet. This in an extreme example, but in practice a large difference will be found.

The same thought applies to reinforcing steel for concrete.

In brick work practically the same cost is incurred, whether the wall is 12 inches thick or 36 inches. Surely, the cost per thousand is different.

The labor cost of pile driving is made up of two labor charges, viz: 1st. Rigging and Removing Outfit; 2nd. Driving. Assuming a cost to rig and remove outfit of $300.00 and two jobs—one of 3,000 lineal feet and one of 30,000 lineal feet—when it comes to the actual driving the cost should not vary to any great extent, yet the rigging and removing in the first case is ten cents per lineal foot and in the second case, one cent. Wild bids can many times be explained this way.

Be sure to analyze each item, and following through the job in imagination determine all the elements which enter into each operation. Build the job step by step in your own mind and thereafter you will never set down any guess costs or take snap judgment that the cost is so much because on another job that was the result.

As an illustration of this form, suppose we take as an example a concrete job of any character requiring excavation, piling, foundation concrete, superstructure concrete, forms and centers, reinforcement and cement finish. This Estimate is carried to completion two ways: 1st. For lump sum bid; 2nd. For unit price bid. General charges are included, but for the present we will pass the detail determination of same, as an entire article will be little enough space to give to this element of the cost, which in its insidious way eats into the anticipated profits, sometimes to final dissolution.

Upon the face of this Estimate Sheet we have every detail calculation of the cost and why it is so. By simply referring back to the Itemized Quantity Estimate we have detail calculation of the quantities and why it is so. There is no guess work about such a system, for even if some items are uncertain of determination by the plans such items stand by themselves and can be verified or mention made in the proposal that a certain amount has been estimated.

Any questions by the owner or architect can be answered at once and definitely. Any eliminated items can be deducted without recalculations.

Plate VIII contemplates that when any portion of the work is to be sub-let, still the contractor will make his own estimate of the quantity of such work and what in his judgment is a fair unit price. This method serves as a check on the

sub-bidders and also provides a basis for determining the unit prices at which the various sub-bidders are estimating.

The first three columns are used for the contractor's own estimate, while the balance of the sheet is for tabulation of sub-bids.

Both Plates VII and VIII should be 8½ x14 inches, as this size is just as convenient for filing and the extra length saves labor in forwarding totals.

The "Outline of Work," "Itemized Quantity Estimate" and the two forms of "Itemized Cost Estimate" should be bound together in order, preferably on the side in a loose leaf binder. Each Estimate as made should be placed in this binder in the order of the estimate number and an index provided.

In a large office it is better to file the Outline of Work and Itemized Quantity Estimate in one binder in the estimating or engineering department, while the Itemized Cost Estimate is personally in the hands of the contractor or a strictly confidential employee.

The amount to be added to the estimate for rental or depreciation of plant and equipment depends upon the "Scheme of Operation." The writer's practice in the case of new equipment is to add to the estimate the difference between the cost price and the second-hand sale value, using judgment in the determination of this depreciation with regard to the character and probable wear and tear of each class. This depreciation will, however, usually vary from 40 per cent. to 60 per cent. In the case of equipment on hand, it is a matter of choice whether a rental is added in addition to profit or whether the use of such a plant shall be considered as included in the added profit and thus presumably gain an advantage over less fortunate competitors. The subject of maintenance of equipment is, however, a separate charge over and above any rental or depreciation and is a true cost to be charged to each job. Various methods have been suggested, but for simplicity the writer advocates a Repair Account which forms a part of the General Charge. This subject will be treated under a separate article wherein all of the proper charges to the accounts will be listed. Properly speaking, this is "Material Cost Bookkeeping" and arises and should be treated under Construction.

Only under exceptional cases should rentals or depreciation be added as part of the unit cost of any item. By so doing a fictitious idea is obtained of the estimated cost of the item and in addition the total amount set aside for this cost can only be obtained by recalculation. In addition, the method is cumbersome and indefinite and will not stand investigation and analysis as will the percentage method of General Charge. The method of charging out the difference between the cost and second-hand selling value in the case of new equipment is based on the theory that the repair account is charged to the job and that if the plant is properly looked after the machinery is always in first-class second-hand condition and may so be carried on inventories. If a rental is charged or in case equipment is leased to others, 10 per cent. per month or a life of ten months on the first cost is not unreasonable, except on large contracts, on the theory that the plant as earning investment, less repairs, is worth the price.

In making the estimate, arrange the items in the logical order of sequence, as they would naturally occur in the actual construction. Building up the estimate in this way there is very little chance of overlooking items. A contractor who lacks imagination is certainly in the wrong line of work. Such a mental construction of the proposition, step by step, will many times call to attention items which do not appear in the plans and specifications. We can not anticipate all contingencies, but it is possible to build in the mind a model of the particular proposition.

Throughout, the idea of this series of articles has been to refrain from stating any cost data based on actual experience, on the idea that such costs are of little value, except to the individual to whom they occur, and *that* in his own "bailiwick." Our purpose has been to emphasize the methods whereby each individual, in any locality, can analyze and develop his own system.

Material costs are readily obtainable. Labor costs are uncertain, depending as they do on character, class, nationality, and environment of men employed and the circumstances and difficulties surrounding the work. We are writing for the contractor of experience who will accept suggestions as to methods, and for the young man who desires the ground work upon which to build up an organization. The contractor knows his labor and what he can expect as a day's work. The young man should serve his time with an established organization, keeping his own notes and forming conclusions which, if supplemented by system and proper consideration for overhead and general charge expenses, should enable him to start well prepared for prosperous experience. The young man can gain ideas of the efficiency of men by service as a timekeeper or sub-foreman, but will, in the majority of cases, miss many items of cost which do not appear in the field and which are confidential with his employer. It is to supply this lack that these articles will only consider or give actual results on costs other than material and labor.

Waste of Water in Buffalo, N. Y.

By a Special Correspondent.

THE City of Buffalo has the largest pumping station of any city in the world. It is also the most wasteful user of water. These and many other facts were conclusively shown in the recent report of the investigating committee of the Chamber of Commerce and Manufacturers' Club.

The Massachusetts street pumping station, the one which now supplies the city with water, contains four vertical pumps with a capacity of 30,000,000 gallons each; two horizontal pumps with a capacity of 20,000,000 gallons each; three electrically driven pumps with a capacity of 25,000,000 gallons, or an aggregate of 235,000,000 gallons per twenty-four hours. There is no pumping station in the world which has an equal pumping capacity.

According to the report of the water bureau for the year ending June 30, 1910, by steam and electricity, there were pumped 50,847,621,780 gallons of water, or a daily average of 139,308,552, or a per capita consumption of 328 gallons per day. This shows the city to be the most wasteful user of water in the world, a record which is especially unenviable inasmuch as every gallon of water has to be pumped.

All but one of the daily papers and many of the citizens refer to this wasteful use of water with boastful pride and say, "Why shouldn't we use as much, or more if we want to, when we have an inexhaustible supply right at our door?" On the other hand, there are many citizens besides several organizations, including the Chamber, who take the opposite view and believe that this enormous per capita consumption could be cut two-thirds at a large saving to the city and without impairing the health of the city nor unduly stinting the individual.

For nearly two years the city has been in an uproar over this and equally important questions relating to the administration of the water bureau. This discussion was precipitated by an investigation by a committee of the Chamber of Commerce, the object of which was, primarily, to prove that a duplicate pumping station was not necessary at this time; that the present pumping station and equipment was wholly adequate for present needs and for twenty-five years to come.

The Chamber has proceeded in a thorough and businesslike manner, employing legal, accounting and engineering talent of unquestioned ability. Dr. W. R. Patterson, formerly with Haskins and Sells of New York City, who had been employed by the Bureau of Municipal Research in its exhaustive work among the departments in New York City, was employed as an expert accountant. George H. Benzenberg of Milwaukee, Major Cassius M. Gillette, formerly Chief Engineer of the city of Philadelphia; Henry Japp and Ernest P. Goodrich of New York City, and Charles C. Hopkins, formerly New York State expert examiner for the Civil Service Commission in engineering, were employed as experts in the matters of engineering.

After many months of careful work, endeavoring at all times to put the best construction on the methods pursued by the various departments under discussion and at the same time to bring out the facts without fear or favor, the committee has made a report as to its findings, as follows:

"There is no uniform method of accounting. Each department keeps its books in its own way, resulting in much confusion, inaccuracy, needless expense and the practical impossibility of ascertaining the actual and contingent assets and liabilities of the city, or the cost per annum of the operations of important subdivisions of department work.

"Money obtained from the sale of long time bonds issued for permanent improvements has been diverted to maintenance accounts under misleading headings, in an apparent increase in the cost of the water works and deceiving the taxpayers as to the cost of operating the Bureau of Water.

"Purchases in excess of $500 without advertising for bids are frequently made and are covered by two or more orders, given sometimes on the same day, for parts of the same thing. This is a technical evasion of the charter by the use of the "split voucher," a pernicious and evil practice.

"The city pays a higher price for supplies than is consistent with sound management. It should purchase all supplies through a duly authorized agent with due regard to economy.

"The recommendations of the Commission of Engineers, employed by the city prior to this investigation have been disregarded in so many particulars that the cost, up to date and contemplated work, has amounted to more than double the original estimate. The approximate estimated cost of the entire new water works, exclusive of the purchase of one

25,000,000-gallon electric pump and the rebuilding of the old station and repairs to boilers, pumps, machinery, etc., was as follows:

ESTIMATE OF COMMISSION OF ENGINEERS.	
Intake tunnel, shafts, conduits, etc	$ 900,000.00
Porter avenue pumping station with equipment	900,000.00
Changes in force mains and valves at present station.	50,000.00
New large water mains	800,000.00
High-service reservoir	50,000.00
Contingencies, etc	100,000.00
	$2,800,000.00

"The contrast between the above estimate with the following statement of the actual and proposed expenditures is too great to be reconciled with wise and economic management:

Intake tunnel, shafts etc	$1,528,296.25
New Porter avenue pumping station with proposed equipment	1,518,434.58
New large main and pipe extension	1,225,972.07
High-service water tower (Kensington water tower).	63,315.04
Rebuilding and equipment of old pumping station	937,341.80
Total	$5,273,359.84
From this certain minor reductions should be made amounting to	4,562.58
Leaving the actual total cost.	$5,268,797.26

"The last-named total does not include the proceeds of the old bond issue for $500,000, which was expended partly upon pipe extension and partly upon the station. Nor does it include the proposal to lay twenty-one miles of water mains at an estimated cost of $1,500,000. The result is that if no economies can be effected by changes in the plant at this date, the city will have spent on its new water works and extension of the old, the sum of $7,268,979.26, instead of the $2,800,000, which it was led to believe would be the cost.

"Although the original estimate of the Commission of Engineers provided only for an expenditure of $50,000 on the old pumping station, it has been rebuilt from the foundation up, and with the installation of the pumps already purchased for it, and added to the present capacity of 235,000,000 gallons, will make the enormous daily pumping capacity of 255,000,000 gallons.

"As rebuilt, the old station is a fireproof structure, equipped with modern machinery, insuring high efficiency in operation. It is isolated, with no exposure hazard to fire. As it is located between the railway tracks and the river it has been claimed that a train wreck might occur and the locomotive and cars might crash into the new station, putting it out of commission. Such an occurrence is a physical impossibility, because the pumping station is located on the inner arc of the curve in the railroad at that point, and any accident to a moving train would throw it away from the station rather than into it.

"The present population of Buffalo is 423,715. Allowing for a larger annual increase in the population, and placing two pumps—one of 25,000,000 and the other of 30,000,000 gallons capacity, or a total of 55,000,000—in reserve, the station would have a working capacity of 200,000,000 gallons per day. At the present per capita daily consumption, 323 gallons, the old pumping station as now rebuilt and re-equipped, would furnish an adequate water supply for a population of 615,000, or nearly 200,000 more than the population of the city today."

If the water supply was metered, as in many other cities, the present pumping station would be able to furnish an abundant supply for 1,600,000 people. To show the sharp contrast between a metered and an unmetered water supply, the following in quoted from an editorial in the Live Wire for February, 1911, the official organ of the Chamber of Commerce:

"On Sunday, January 15 (1911), the available pumping capacity consisted of four vertical pumps, each with a capacity of 30,000,000 gallons; two horizontal pumps, each with a capacity of 20,000,000; three electrically driven pumps, each with a capacity of 25,000,000, making an aggregate of 235,000,000 gallons per twenty-four hours. On that date, at the time of my visit, the four vertical and two horizontal steam pumps were being used and one electrically driven pump, or an aggregate pumping capacity of 185,000,000 gallons per twenty-four hours. Whether all these pumps were used for the full twenty-four hours, or worked to their full capacity or not, I am unable to say, as I have not been able to consult the records subsequently. On that day there was held in reserve a pumpage capacity of 50,000,000 gallons.

"On the same day in the city of Cleveland all its water was pumped from the Kirtland pumping station. Two pumps were used, each with a capacity of 25,000,000, or a total of 50,000,000 gallons. The Venturi meters on the discharge mains showed the actual total pumpage for that day to be 44,600,000 gallons.

"The fact that the city of Cleveland has a population of 560,663, and Buffalo 423,715, coupled with the fact that Cleveland obtains its supply from the same

source, not only makes the foregoing statement the more significant, but proves beyond any question of doubt that the city of Buffalo is simply wasting its water and thereby confirms the repeated statements of the Bureau of Water of Buffalo."

In its investigation the Chamber became thoroughly convinced that the installation of meters on the domestic, as well as the manufacturing services was the one policy to pursue as a means of preventing the waste of water. Commissioner Francis G. Ward, on January 11, 1905, sent the following communication to the president of the Common Council, which shows that Mr. Ward was then in harmony with the recommendations of the Chamber of Commerce:

"Hon. Thomas Stoddart, Acting Mayor,
Buffalo, N. Y.

"Dear Sir:—For twenty-four hours, ending A. M. of January 11th, there were pumped 164,509,560 gallons.

"The capacity of the pumping station is 187,000,000 gallons of water per twenty-four hours. No. 5 pump being disabled reduced the capacity to 167,000,000 gallons. The danger of wrecking the pumps when the ice was running caused them to shut down more or less during the twenty-four hours ending 7 A. M. January 10th.

"Assuming the population of Buffalo to be 400,000, according to all well-known standards, 100 gallons per capita per day is considered a liberal supply. This would require 40,000,000 gallons per twenty-four hours and when the so-called water famine, as announced by the press, existed, we had pumped over three times this quantity. The remedy:

"First, change inlet pier to Horse Shoe Reef and construct tunnel from same at present station—cost estimated, $300,000—as free and clear water can always be obtained at this point—a record of twenty years shows this conclusively. The present location of the inlet pier, in the neck of the river, is the worst in the vicinity of Buffalo, from the standpoint of ice conditions and pure lake water.

"Second, means to be taken to prevent the present wasteful use of water by consumers, which can only be stopped by meters.

"Time required, four to six years.

"Consumers, 70,000.

"Average cost of meters, $10.00 each; total cost, $700,000.

"Respectfully yours,
"Francis G. Ward, Commissioner."

From present indications it would seem that Buffalo would continue in the black list column, as the most wasteful city in the world, because the Chamber of Commerce seems to have gotten "cold feet" immediately after issuing its report. Whether the fact that the entire directorate was served in a $50,000 libel suit, brought in the name of two of Mr. Ward's subordinates, has caused a complete silence on the part of the Chamber or not, does not yet appear. The fact that the entire Water Bureau of Buffalo needs a thorough house cleaning is proven by the report of the Chamber of Commerce.

Investigations of Water Waste in Memphis, Tenn.

Report by Carl E. Davis, Resident Engineer of Water Department.

LATE in 1909, on recommendation of the Chairman, the Board of Water Commissioners of Memphis decided to make a study of water wastes of various kinds with a view to their prevention.

Population statistics were gathered during the winter and actual measurements begun in April under the direction of the engineering department.

METHOD OF INVESTIGATION.

The method employed is what is known as the Deacon system, which has been long used abroad, and in detail is as follows:

When the area to be investigated is defined a complete list of all the connections, metered and unmetered, in the district is obtained from the records kept by the department. The amount of water passing through each meter is obtained from the meter department, and from the census taken by this division the number of persons supplied by each connection is obtained. From these data the average per capita metered consumption is computed.

While the record for the district is being compiled all the valves in the district are inspected and those not in good condition are reported to the street department for repairs.

When this preliminary work is finished the valves along the boundary of the district are closed; a pitometer is installed on the supply main feeding the district and the water consumed by the district is measured for a period of about seven days. From this test the average daily consumption and the consumption during the night, when the use of water is low, is determined.

If the amount of water consumed is abnormal the district is subdivided and the consumption of each subdivision measured. The subdivisions showing abnormal rates are selected and tested as follows:

A pitometer is put in operation on a supply main feeding the sub-district, with the boundary valves closed. The area is then narrowed down in successive steps by closing the interior valves and opening the boundary valves. In this manner sections are cut off until the smallest division is reached. As each section is cut off a simultaneous drop in the flow is indicated by the pitometer. The drop or amount of decrease in the flow is the volume of water used by the portion cut off. By this means the unaccounted for consumption is located between valves. These tests are made between the hours of 1 and 5 a. m., for, at that time, the consumption is at a minimum and the rate of flow usually nearly constant.

The sections using the unaccounted for amount are inspected by testing out each connection with the water phone. This enables the inspector to detect any leaks, whether in fixtures or in the service pipe below the surface. He is also, very often, able to detect leaks in the main in the vicinity of the connection being inspected.

Where leaks are found within property lines the owners are given notice to make repairs. Other leaks located are reported to the street department. After repairs are made the sub-district is again tested at night, and if the unaccounted for consumption is still large enough to justify it, the main is uncovered in different places until the source of waste is located.

After each sub-district is tested in this manner and all leaks that can be located are repaired, the consumption of the entire district is again measured for a period of several days to determine the amount of water saved.

SOURCES OF LEAKAGE.

The principal sources of leakage found may be briefly described as follows: Wrought iron pipe supplies; service pipes; house fixtures; fire hydrants; flush tanks.

It was apparent soon after the beginning of the work of inspection that the flush tanks were, in almost every instance, wasting water, some more than others. After the inspection of the first six districts the department decided to have all the tanks in the city inspected at once, and employed men for that purpose, under the direction of the secretary of the department. Up to this time 67 flush tanks have been inspected by the pitometer division, of which 9 were found discontinued and the remaining 58 wasting 106,000 gallons per day, an average of 1,827 gallons per day per tank. If the remaining 307 operating tanks in the city are wasting water at the same rate, repairing them would make a saving of 561,000 gallons per day.

While the inspection of these tanks was not made by the pitometer division, the necessity for it was shown by previous inspection made by this division.

The mains were found in good condition, all the leaks located in them being joint leaks. In most cases these leaks were caused by the jarring of street cars.

The following report shows in detail the work done in each district and its results.

DISTRICT NO. 1.

This district is bounded on the north by the north line of Chelsea avenue, on the east by the east line of Seventh street, on the south by the north line of Auction avenue, and on the west by the east line of Second street. The mains on Keel and Looney avenues lying west of Second street are also included.

Along the north and east sides is a first-class residential district. That part lying west of Second street is a manufacturing district. The remainder is occupied by a thrifty population that, as a rule, own the property on which they live, and consequently the plumbing was generally found to be in good repair. The area covers 134 acres and contains 4.5 miles of mains, and has a population of 3,862; of these, 2,742 are white and 1,120 are black.

Metered Consumption. — The metered population is 1,809, and the average daily consumption is 50,457 gallons, or 28 gallons per capita. Of the number on metered supplies there are 1,190 whites and 619 blacks. The average daily consumption of the whites is 33.2 gallons and of the blacks 17.6 gallons per capita.

Total Consumption.—The consumption was measured from April 15th to April 21st, inclusive, and the average rate of 274,000 gallons per day obtained. The average minimum rate was 172,000 gallons per day, or 63 per cent of the daily rate of supply. The average daily rate of consumption per capita for the entire district was 71 gallons, and the unmetered consumption 108 gallons per capita per day.

Inspection.—The district has 459 house connections and 11 flush tanks, all of which were inspected. In the inspection of the house connections 15 stop boxes were found filled and were dug up and cleaned out.

Of the 11 flush tanks, 3 were not operating and 8 were wasting 13,000 gallons per day. The leaks found were as follows: 10 property leaks; 7 leaks in supply pipes in the streets; 3 leaking fire hydrants; 2 leaking valves.

Where property leaks were found the owners were given notice to make repairs. Other sources of waste were reported to the street department for repairs.

Resurvey.—After repairs were made another test was made on the district, and a daily consumption of 239,000 gallons per day was shown. This shows a reduction of 35,000 gallons per day, or 13 per cent. of the original consumption. The consumption for the entire district is now 62 gallons per capita per day, the metered 28 gallons per capita per day, and the unmetered 91 gallons per capita per day. The unmetered supply includes water used for sprinkling streets, flush tanks, watering troughs, etc.

DISTRICT NO. 2.

This district is bounded on the north by Chelsea and Vollentine avenues, on the east by Cypress Creek, on the south by Jackson avenue, and on the west by Seventh street. It is almost entirely occupied by middle-class residences, with a few small suburban stores. The area is 344 acres, and has 10.4 miles of mains. The population is 5,836, 4,764 whites and 1,072 blacks.

Metered Supply.—The metered supply from records of the meter department for 1909 for this district was 54,294 gallons per day. The metered population is 2,836 and the average daily consumption is 19.1 gallons per capita. Of the metered population, 2,058 are white and 778 black. The average daily consumption of the white is 21 gallons and of the blacks 14.2 gallons per capita.

Total Consumption.—The first test for total consumption was made from May 10th to May 20th, 1910, inclusive, and the average found to be 470,000 gallons per day. The average minimum night rate was 319,000 gallons per day, or 68 per cent. of the daily rate of supply. The average daily consumption per capita for the entire district was 81 gallons and the unmetered consumption 138 gallons per day per capita.

Inspection.—In this district there were 864 house connections and 14 flush tanks inspected. In the inspection of the house connections 39 stop boxes were found filled and were dug up and cleaned out. Of the 14 flush tanks, 5 were in good condition and 9 were wasting 23,500 gallons. Other sources of waste found were:

14 property leaks. (Owners were given notice to make repairs.)

12 leaking supply pipes in the streets.

1 leak in main corner of Oak street and Chelsea avenue, wasting 15,000 gallons per day. This leak had blown a hole in the joint of a drain pipe and was discharging directly into it.

1 leak in main corner of Argyle street and Chelsea avenue.

2 leaks in wrought iron supply pipe in Short Saffarans street.

5 fire hydrants.

3 valves.

All leaks except those on private property were reported to the street department for repairs.

Resurvey.—After these wastes were repaired the consumption of the district was again measured and an average rate of 394,000 gallons per day obtained. This shows a reduction of 76,000 gallons per day, or 16 per cent. of the original consumption. The average per capita consumption now is 67.6 gallons per day. The metered consumption is 19.1 gallons and the unmetered consumption 113 gallons per capita per day.

DISTRICT NO. 3.

This district is bounded on the north by Auction avenue, on the east by Maiden Lane as far south as Jackson avenue, and from there to Washington avenue; the eastern boundary is Court House alley. It is bounded on the south by the south line of Washington avenue, and on the west by Front street, but does not include the 36-inch main on Front street. This is largely a business district, but it also contains a number of low-class tenements. Its area is 112 acres, and has 2.8 miles of mains. As it is a business section, its population is a shifting one, and could not be accurately enumerated. Most of the services are, however, metered, there being 1,348 people on flat rate services.

Metered Consumption. — The average daily metered consumption for 1909 was 96,337 gallons.

Total Consumption.—The total consumption of the district was measured from June 20th to June 28th, inclusive, and found to be 358,000 gallons per day. The average minimum night rate was 248,000 gallons per day, or 69 per cent. of the average daily rate of supply.

Inspection.—All connections, both metered and flat rate, numbering 502, were inspected; also 5 fire cisterns and 10 flush tanks. The connections to the fire cisterns were found in good condition. Of the flush tanks, 4 were found discontinued. In inspecting the house connections, 43 stop boxes were found to be filled and reported to the street department to be cleaned out.

Leaks were found as follows:

5 underground property leaks. (Owners given notice to make repairs.)

5 connections with leaking fixtures. (Owners given notice to repair.)

2 leaks in supply pipes in the streets.

3 fire hydrants.

1 leaking valve.

6 flush tanks wasting 9,000 gallons per day.

All sources of waste other than those on private property were reported to the street department for repairs.

Resurvey.—After repairs were made the consumption of the district was again

measured and an average daily rate of 292,000 gallons obtained, which indicates a saving of 66,000 gallons per day, or 18 per cent. of the original daily consumption of the district.

DISTRICT NO. 4.

District No. 4 is bounded on the north by Vollentine avenue, on the east by Manassas street, on the south by Chelsea avenue, and on the west by Second street. It also includes the 20-inch main on Second street from Jackson avenue north and all the mains lying west of Second street north of Chelsea avenue, and the 4-inch main on Park street north of Vollentine avenue. The northern and western parts are occupied by saw mills and lumber yards; the remainder is occupied by a good class of suburban residences. The area is 205 acres, containing 5.5 miles of mains and a population of 4,664, of which 3,717 are white and 947 are black.

Metered Consumption. — The metered population is 2,689; of these 1,977 are white and 712 black. The total average daily metered consumption is 39,740 gallons per day. The average consumption per capita per day is 148 gallons. The whites on an average use 16 gallons per capita per day and the blacks 11.7 gallons.

Total Consumption.—The consumption of the entire district was measured from July 21st to July 25th, and the average daily consumption was found to be 316,000 gallons, a per capita consumption of 58 gallons per day. The average minimum night rate was 156,000 gallons, or 49 per cent. of the daily rate.

The unmetered population is 1,975, with consumption of 139 gallons per day per capita.

Inspection.—In inspecting this district 586 house connections were tested and all flush tanks (4 in number) were examined. The following sources of waste were found:

16 underground leaks in supply pipes in the streets.

7 property leaks. (Owners given notice to make repairs.)

2 leaking fire hydrants.

1 leaking valve.

4 flush tanks wasting 10,500 gallons per day.

In inspecting house connections 37 stop boxes were found stopped up and were taken out and cleaned.

Resurvey.—The final test of the entire district, after repairs were made, showed a minimum rate of consumption of 53,000 gallons per day, a reduction of 103,000 gallons per day, or 32 per cent. of the original consumption. This reduces the daily consumption per capita to 45 gallons and the unmetered consumption to 90 gallons per capita per day.

DISTRICT NO. 5.

This district is bounded on the north by the south line of Lane avenue, on the east by the west line of Decatur street, on the south by the north line of Poplar avenue, and on the west by the east line of Manassas street. Its area is 115 acres and has a population of 2,538, and contains 2.5 miles of mains. It is mostly a colored tenement house district, and contains 342 whites and 2,196 blacks.

Metered Consumption. — The metered population is 1,036, of which 174 are white and 862 black. The average daily consumption is 23,920 gallons, or 23 gallons per capita per day. The average consumption of the whites is 48 gallons per capita per day, and of the blacks 18 gallons.

Total Consumption.—The total supply was measured for a period of five days, from August 14th to August 18th, inclusive, and showed an average daily flow of 185,000 gallons, with an average minimum night rate of 147,000 gallons per day, which was 79 per cent. of the average daily rate. The average daily rate of consumption per capita was 73 gallons. The unmetered consumption was 107 gallons per capita per day.

Inspection.—This district has 389 house connections and 4 flush tanks. In the inspection of the house connections, 26 stop boxes were found stopped up and were cleaned out. Of the 4 flush tanks, 2 were not operating.

Leaks were found as follows:

15 property leaks. (Owners given notice to make repairs.)

8 leaks in supply pipes in the streets.

1 leaking fire hydrant.

2 leaking valves.

2 flush tanks wasting 30,000 gallons per day.

Leaks not on private property were reported to street department for repairs.

Resurvey.—The minimum night rate after repairs was made was 66,000 gallons per day. This shows a reduction in consumption in the district of 81,000 gallons per day, or 43 per cent. of the original supply. The average consumption for the district was reduced to 40 gallons per capita per day, and the unmetered consumption to 54 gallons per capita per day.

DISTRICT NO. 6.

This district lies between Jackson avenue, Poplar avenue and the east line of Manassas street, and also includes the Lane avenue main and its branches on the north side as far east as Ayres street. The northern and eastern sections are covered by a poor class of rental property, the southern and western sections by a good class of residences. The area covers 170 acres and has 5.8 miles of mains and a population of 5,423, of which 3,939 are white and 1,484 are black.

Metered Consumption. — The metered population is 2,448, and the average daily consumption of 53,856 gallons, or 22 gal-

lons per capita. Of the number on metered supplies, there are 1,429 whites and 1,019 blacks. The average daily consumption of the whites is 25 gallons, and of the blacks 18 gallons per capita.

Total Consumption.—The total consumption was measured from October 10th to October 15th. The average daily flow during this test was 300,500 gallons, with a minimum night rate of 122,500 gallons per day, which is 47 per cent. of the average daily consumption. The total average consumption per capita was 55 gallons per day, and the unmetered consumption 82 gallons per capita per day.

Inspection.—The house connections, 855 in number, 24 flush tanks and 2 fire cisters were inspected. Of the flush tanks, 6 were found in bad condition and wasting 20,000 gallons per day.

Other sources of waste were:
12 leaking fixtures.
7 leaks in supply pipes in streets.
3 leaks in fire hydrants.
2 leaks in valves.
1 leak in the main on High street.

During this inspection 156 stop boxes were found to be filled and were either cleaned out or reported to the street department to be cleaned.

After repairs were made the consumption of the district was again measured, the result of which shows that some new sources of waste had developed since the previous test that brought the consumption up to an amount practically equal to the original.

Another inspection was made and the following leaks were found:

16 leaking fixtures.
4 leaks in supply pipes in the streets.
5 leaking fire hydrants.
4 leaks in mains.

After repairing these leaks a test of the district showed that the daily consumption had increased instead of being decreased. A third inspection was made and 16 leaking fixtures found. The repairing of these leaks did not reduce the consumption and a final test of the district showed an everage daily consumption of 344,000 gallons per day, with a minimum night rate of 250,000 gallons per day, which is 73 per cent. of the average daily rate.

The consumption of the water during the night is not confined to any locality, but spread over the entire district. The temperature at the time of this test was low, and the waste may have been caused by water being allowed to run to prevent freezing of fixtures. This district will be worked over again when the weather becomes suitable.

Total number of leaks found:
44 places with leaking fixtures.
11 leaks in supply pipes in the streets.
5 leaks in mains.
8 leaks in fire hydrants.
2 leaks in valves.
6 leaks in flush tanks.

Resurvey.—The saving of waste in this district that could be measured was the 20,000 gallons per day in the flush tanks, 5,000 gallons per day in 3 fixtures on Jones avenue, and 15,000 gallons per day in a leak in the main on High street, making a total of 40,000 gallons per day. If there had been any way to measure the amount saved by repairing other leaks this amount would have been considerably larger.

DISTRICT NO. 7.

This district is bounded on the north by the south line of Washington avenue, on the east by the east line of Court House alley, on the south by the north line of Union avenue, and extends west to the Mississippi river, but does not include the 36-inch main on Front street. The area covers 90 acres and has 3.4 miles of mains. Being a business district, the population is a shifting one and could not be enumerated. There are 477 connections, of which 369 have meters and 108 are unmetered. The population on unmetered supplies is 429. Among the unmetered supplies there are 12 connections to business houses where there was no way of getting at the amount of water consumed.

Metered Consumption. — The average daily metered consumption is 468,000 gallons. The fountain in Court Square uses, according to pitometer measurement, 27,000 gallons per day, and 3 flush tanks use 1,500 gallons per day, making a total of 496,500 gallons per day.

Total Consumption.—The consumption of the district was measured for a period of 7 days, from October 21st to October 27th, inclusive, and the daily average found to be 623,000 gallons. The average minimum night rate was 291,000 gallons per day, or 49 per cent. of the daily rate. Allowing 26,000 gallons per day (60 gallons per capita) for the unmetered population, the accounted for daily consumption is 422,500 gallons, leaving 100,000 gallons per day unaccounted for. From this 100,000 gallons is to be deducted the amount used by the 12 flat rate connections mentioned above, and also the water used for street flushing.

Inspection.—The seven flush tanks in the district were inspected and 4 found to be discontinued. The three that were operating were in good condition.

The district was carefully tested to locate any section that might be using an unusual quantity of water at night. During the night tests the street connections were inspected. The water used at night was all traced to connections, with a few exceptions, which amounted to very little. During the inspection 2 leaks in valves and 2 leaks in supply pipes, aggregating 3,000 gallons per day, were reported to the street department for repairs.

TABLE SHOWING RESULTS OF WASTE WATER INSPECTION BY PITOMETER DIVISION, CITY OF MEMPHIS, 1910.

District Number.		1	2	3	4	5	6	7	Totals
1	Area in acres	134	344	112	205	115	170	90	1,170
2	Metered population	1,809	2,836	.....	2,689	1,036	2,448	.....	.....
3	Unmetered population	2,053	3,000	1,348	1,975	1,502	2,975	429	.....
4	Total population	3,862	5,836	.....	4,664	2,538	5,423	.....	.....
5	Metered supply .....gallons per day.	50,457	54,294	96,337	39,740	23,920	53,856	500,080	818,684
6	Unmetered supply .....gallons per day.	223,543	415,706	261,663	276,260	161,080	246,644	122,920	1,707,816
7	Total supply .....gallons per day.	274,000	470,000	358,000	316,000	185,000	300,500	623,000	2,526,500
8	Metered consumption per capita.....gallons per day.	28	19.1	.....	14.8	23	22	.....	.....
9	Unmetered consumption .....gallons per day.	108	138	.....	139	107	82	.....	.....
10	Miles of mains	4.5	10.4	2.8	5.5	2.5	5.8	3.4	34.9
11	Number of connections	459	864	503	586	389	855	477	4,132
12	Property leaks	10	14	10	23	15	44	.....	116
13	Leaky supply pipes	7	14	2	.....	8	11	2	44
14	Leaks in mains	.....	2	.....	.....	.....	5	.....	7
15	Leaking valves	2	3	1	1	2	2	2	13
16	Leaking fire hydrants	3	5	3	2	.....	8	.....	21
17	Leaking flush tanks	8	9	6	4	2	6	.....	35
18	Total number of leaks	30	47	22	30	27	76	4	236
19	Number of stop boxes cleaned out	15	39	43	37	26	156	1	317
20	Number of connections inspected	459	864	502	586	389	855	235	3,890
21	Number of flush tanks inspected	11	14	10	4	4	24	7	74
22	Consumption per capita before inspection (gallons per day)	71	81	.....	68	73	55	.....	.....
23	Consumption per capita after inspection (gallons per day)	62	67.6	.....	45	40	.....	.....	.....
24	Total consumption after making repairs	239,000	394,000	292,000	213,000	104,000	.....	.....	.....
25	Reduction in consumption	35,000	76,000	66,000	103,000	81,000	40,000	3,000	404,000
26	Percentage of original consumption saved	13	16	18	32	43	13.3	5	16

The waste in the district was so small, as shown by 84 per cent. of the total consumption being actually accounted for with the supply to the 12 connections already mentioned and the water for street flushing to be deducted from the remaining 16 per cent., it was decided that it would not be economical to attempt to locate it.

The amount charged against the pitometer work for the year 1910 was $4,251.82, which included the cost of tools and the expenses of gathering census statistics, of which there are enough on hand for the coming year's work.

Valuing the water saved at $40.00 per 1,000,000 gallons, the amount saved for the year is approximately $5,900.00, a saving of $1,648.18 for the year. With a slight increase in the force, the pitometer can be worked much more efficiently, thereby decreasing the cost of the survey for the coming year per thousand gallons.

Taking the results of the work done during the year 1910 as a basis for an estimate, it shows that there is in that part of the city not yet tested a leakage of approximately 2,500,000 gallons per day that can be eliminated.

While the consumption of the city is not large, as compared with other cities, that it is excessive is readily borne out by the fact that in 1909 the total pumpage for the city was 5,116,855,804 gallons, of which 1,228,625,250 gallons passed through meters, leaving 3,888,230,554 gallons to be used through flat rate connections. It is estimated that the city of Memphis was furnished, free of charge, approximately 365,000,000 gallons, which leaves 3,523,230,554 gallons to be either wasted or used by the flat rate consumers. At that time 40 per cent. of all connections were metered, thus leaving 60 per cent. of the connections to use 74 per cent. of the water supplied to private consumers.

In 1909 the income from the 1,228,625,250 gallons sold through meters was $221,361.44 or 18 cents per 1,000 gallons, while from 4,751,855,804 gallons used by flat rate consumers the income was $138,712.95, or 2.9 cents per 1,000 gallons. Where the waste is due to carelessness it can be prevented by the installation of meters; but other sources of waste can only be eliminated by careful inspections.

Standard Tests for Bituminous Road Materials.

Report of Committee of American Society for Testing Materials—Logan Walter Page, Chairman.

DURING the past year the Committee on Standard Tests for Road Materials of the American Society for Testing Materials has worked along the lines planned at the last annual meeting, which were described in its report for 1910. A number of the special committees on Bituminous Paving Materials have done valuable work in investigating existing methods and devising new methods for the examination of such materials. The reports of these special committees have been considered by the main committee which recommended the following four methods for adoption as provisional by the Society: 1. Proposed provisional method for the determination of soluble bitumen. 2. Proposed provisional method for the determination of the penetration of bitumen. 3. Proposed provisional method for the determination of the loss on heating of oil and asphaltic compounds. 4. Proposed provisional method for sizing and separating the aggregate in asphalt paving mixtures.

The Committee in presenting the proposed provisional method for the determination of soluble bitumen, did not recommend it as the best for general use, as it is longer and in many cases gives no better results than other more expeditious methods, but only as a method to be resorted to in case of dispute, as it seems to have the widest range of applicability of any of the methods considered. Moreover, they stated that with some classes of materials this method will show a lower percentage of soluble bitumen than many of the shorter methods.

The Committee also stated that no great degree of refinement is to be expected from the proposed provisional method for the determination of the loss on heating of oil and asphaltic compound, owing to the fact that no absolutely satisfactory standard oven has yet been found. This matter will be given careful attention during the coming year and it is hoped that an oven will be found or developed which will be an improvement over the one at present recommended.

The proposed provisional methods above mentioned are to be voted on by letter ballot, by the members of the Society. The methods are as follows:

Proposed Provisional Method for the Determination of Soluble Bitumen.

DRYING THE SAMPLE AND PREPARING IT FOR ANALYSIS.

It was decided, owing to the great variety of conditions met with in bituminous compounds, that it is impossible to specify any one method of drying that would be satisfactory in every case. It is therefore supposed that the material for analysis has been previously dried, either in the laboratory or in the process of refining or manufacture, and that water, if present, exists only as moisture in the hydroscopic form.

The material to be analyzed, if hard and brittle, is ground and spread in a thin layer in a suitable dish (iron or nickel will answer every purpose) and kept at a temperature of 125 degrees C. for one hour. In the case of paving mixtures and road materials, where it is not desirable to crush the rock or sand grains, a lump may be placed in the drying oven until it is thoroughly heated through, when it can be crushed down into a thin layer and dried as above. If the material under examination contains any hydrocarbons at all volatile at this temperature, it will of course be necessary to resort to other means of drying. Tar or oils may be dehydrated by distillation and the water-free distillate returned to the residue and thoroughly incorporated with it.

ANALYSIS OF SAMPLE.

After drying, from 2 to 15 grams (as may be necessary to insure the presence of 1 to 2 grams of pure bitumen) is weighed into a 150 C. C. tared Erlenmeyer flask, and treated with 100 c. c. of carbon disulphide. The flask is then loosely corked and shaken from time to time until all large particles of the material have been broken up. It is then set aside for forty-eight hours to settle. The solution is decanted into a similar flask that has been previously weighed. As much of the solvent is poured off as possible without disturbing the residue. The contents of the first flask are again treated with fresh carbon disulphide, shaken as before, and then put away with the second flask for forty-eight hours to settle.

The liquid in the second flask is then carefully decanted upon a weighed Gooch crucible 3.2 c. m. in diameter at the bottom, fitted with an asbestos filter, and the contents of the first flask are similarly treated. The asbestos filter is made of ignited long-fibre amphibole, packed in the bottom of a Gooch crucible to the depth of not over one-eighth inch. In filtering no vacuum is to be used and the temperature is to be kept between 20 degrees and 25 degrees C. After passing the liquid contents of both flasks through the filter, the residue on the filter is thoroughly washed and the residues remaining in them are shaken with more fresh carbon disulphide and allowed to settle for twenty-four hours, or until it is seen that a good subsidation has taken place. The solvent in both flasks is then again decanted through the filter and the residues remaining in them are washed until the washings are practically colorless. All washings are to be passed through the Gooch crucible.

The crucible and both flasks are then dried at 125 degrees C. and weighed. The filtrate containing the bitumen is evaporated, the bituminous residue burnt, and the weight of the ash thus obtained added to that of the residue in the two flasks and the crucible. The sum of these weights, deducted from the weight of substance taken, gives the weight of soluble bitumen.

Proposed Provisional Method for the Determination of the Penetration of Bitumen.

The penetration of bitumen shall be the distance expressed in .01 cm. that a No. 2 needle will penetrate into it vertically without friction at 25 degrees C. under a stated weight applied for a stated length of time, the factors of weight and time being determined as follows:

The material shall first be tested for five seconds under a weight of 100 grams. If this result is less than 10, the penetration shall be determined under a weight of 200 grams applied for one minute; if between 10 and 300, the penetration shall be determined under a weight of 100 grams applied for five seconds; if greater than 300, the penetration shall be determined under a weight of 50 grams applied for five seconds. In every case the factor of weight and time shall be stated when reporting the penetration and whenever possible to obtain both readings, the penetration under a 100 gram weight for five seconds and under the modified weight and time shall be reported. When testing material softer than 100 penetration, a containing receptacle not less than 1¼ inch in diameter shall be used.

It is recommended that the penetration may be determined at 0 degree C. (32 degrees F.) and 46 degrees C. (114.8 degrees F.) in addition to the 25 degrees C. (77 degrees F.) test.

Proposed Provisional Method for the Determination of the Loss on Heating of Oil and Asphaltic Compounds.

The loss on heating of oil and asphaltic compounds shall be determined in the following manner: 20 grams of the water-free material shall be placed in a circular tin box with vertical sides, measuring about 2 cm. in depth by 6 cms. in diam-

eter, internal measurement. The penetration of the material to be examined shall, if possible, be determined at 25 degrees C. and the exact weight of the sample ascertained. The sample in the tin box shall then be placed in a hot air oven (New York Testing Laboratory Oven without fan), heated to 163 degrees C. (325 degrees F.) and kept at this temperature for five hours. At no time shall the temperature of this oven vary more than 2 degrees C. from 163 degrees C. When the sample is cooled to normal temperature, it shall be weighed and the percentage of loss by volatilization reported. The penetration of the residue shall then, if possible, be determined at 25 degrees C. as upon the original material, and the loss in penetration found by subtracting this penetration from the penetration before heating. In preparing the residue for the penetration test it shall first be heated and thoroughly stirred while cooling.

Proposed Provisional Method of Sizing and Separating the Aggregate in Asphalt Paving Mixtures.

The method consists of passing the mineral aggregate through several sieves of the following sizes in the order named:

200 meshes per linear inch, 2.54 c.m., size of wire.....0.00235—(0.05969 mm.)
100 meshes per linear inch., 2.54 c.m., size of wire.....0.0045 —(0.1143 mm.)
80 meshes per linear inch, 2.54 c.m., size of wire.....0.00575—(0.14605 mm.)
50 meshes per linear inch, 2.54 c.m., size of wire.....0.009 —(0.2286 mm.)
40 meshes per linear inch, 2.54 c.m., size of wire.....0.01025—(0.26035 mm.)
30 meshes per linear inch, 2.54 c.m., size of wire.....0.01375—(0.34925 mm.)
20 meshes per linear inch, 2.54 c.m., size of wire.....0.0165 —(0.4191 mm.)
10 meshes per linear inch, 2.54 c.m., size of wire.....0.027 —(0.6858 mm.)

Highways in England.

By a Special Correspondent.

AFTER many years of extreme neglect in this country that branch of municipal administration concerned with maintenance and repair of highways is developing in a most gratifying manner. The reason is not far to seek. The increase in vehicular traffic, both as regards weight and volume, has affected every highway authority in the country, and has, in London, reached an acute stage, and given rise to a very difficult and complex problem, which, every year, presses more for a solution. The enormous and rapidly swelling volume of motor traffic, comprising heavy lorries, vans and omnibuses, in addition to the ever-increasing number of motor-cars and cabs, has not only brought home to the public mind the importance and gravity of the question of rapid and efficient road travel, but has evoked no small amount of criticism of the existing methods of road planning and road construction.

Until quite recent years roads were constructed primarily for the use of horse-hauled traffic. Indeed, any great development of mechanical haulage or propulsion was most effectually prevented by the Locomotives Act of 1865. The man with a red flag, who, in accordance with the provisions of this Act, cautiously preceded such mechanically-propelled vehicles as passed down the roads of our boyhood, is to us a comic memory today, and it would be surprising if the road construction practice which served to meet such conditions were found equal to the present demands of the heavy and high-speed traffic rendered possible by the repeal of the 1865 Act in 1896, and in the passing of such subsequent Acts as the Locomotives Act of 1898, the Motor-car Act of 1903, the Heavy Motor-car Order of 1904, etc.

The Road Board was established under the Development and Roads Improvement Act of 1909 with the object of assisting local authorities in improving the roads of the country in various ways, such as widening them, diverting their course, reconstructing and improving the surface, altering awkward and dangerous curves and corners, raising the level and draining them, widening bridges, and so forth. The chairman of the board is Sir George Gibb, so well known in connection with railway administration, and the members comprise Lord Pirrie, K. T.; Lord Kingsburgh, Lord Justice Clerk of Scotland; Lord St. Davids and Sir Charles Rose.

It was stated in November, 1910, that the applications made to the Board already exceeded $27,500,000, a sum far in ex-

cess of the funds available, which are estimated at about $5,500,000 up to the end of the current financial year.

Experts are busily engaged in deciding how to utilize available new materials by new methods at the lowest cost. One essential is recognized to be the proper waterproofing of the road. The most generally accepted systems here are those concerned with either coating with a reliable tar or tar compound or laying the stone dry and cementing it together with a suitable compound poured into the joints of the stone.

In both these systems the consolidation of the surface by careful rolling so as to ensure a compact watertight road is most important. The cost of these systems is still a matter of considerable discussion.

British engineers and surveyors readily recognize the new methods, but are too often handicapped by having to base their calculations of the cost of tar-macadam on small experiments (hand mixing) carried out at their councils' depot. Items of cost such as capital charges and administration expenses are sometimes overlooked, with the result that an erroneous idea prevails as to the actual cost of effectively carrying out the work. It will be apparent at once that the unfortunate contractor or merchant has to contend with such erroneous ideas of cost, although as a specialist he may have expended a vast amount of time, trouble and money in order to gain his experience of the best method and materials and to put them on the market. Success can only be achieved by the use of the very best materials, coupled with the full knowledge, only acquired by experience, as to the temperatures of the materials at the time of mixing and the proper mixtures. Undoubtedly the machine that can mix the ingredients in definitely gauged quantities is the most reliable, and a portable machine to do such work at the roadside will naturally reduce the cost of transport.

Such a machine is on the market, with the result that today a suitable granite in conjunction with a reliable tar compound can be converted on the spot into the best tar macadam. This development will enable tar macadam to be used in districts where hitherto the cost of transportation has made it prohibitive.

The system of cementing the dry stone on the road has also to some extent proved itself a fairly reliable and somewhat fully justified by the longer life of the cheaper method. In either case although the initial outlay must be more than in the old system of water-bound roads, it is road and the reduced cost of maintenance, thereby proving the cheapest in the end.

The British Institution of Civil Engineers naturally gives considerable attention to road construction and maintenance and interesting papers are read from time to time on those questions. Among recent interesting views expressed there were those of Walker Smith. He suggests the reconstruction of about fifteen thousand miles of roads in England and Wales upon the principle of spreading the cost over a period of seven years. The net result of this, upon the data assumed, is that the whole of this length of roads would be entirely reconstructed in a period of thirty-four years. At no period would the present cost of maintenance be exceeded, while at the twenty-third year a gross annual saving would commence, increasing until, in the forty-first year, there appears a maximum permanent saving of between $10,000,000 and $15,000,000 per annum.

He also recommends the standardization of materials of construction, and for the accumulation of data for the design of future roads. In the case of standardization, it is suggested that there should be commenced and thereafter continued systematic laboratory tests and analyses of stones, the physical and petrological results of which should be recorded for each trial length of road laid under service conditions. These records are suggested with a view to correlate the various physical tests, and further to correlate the physical tests with the petrological descriptions. It is desired to establish ultimately, at least for physical qualities, relative values of stones for bituminous-bound and water-bound macadam.

There should be laid down three or four standards for the bituminous binder, and the subject should be pursued further in the laboratory. The standards for tar itself would enable a number of tests to be eliminated, and reliance to be placed upon a very few. Further, the effects of blending tar with other substances, such as petroleum residues and asphalt in various proportions, could be ascertained, and also the effect of introducing various proportions of inert matter.

Another road expert speaking at the same institution declares that the first essential condition for successful road construction is a good foundation, and states that to provide a proper foundation for the 27,000 miles of main roads in England and Wales would cost $275,000,000. He refers to the heavy motor-car traffic and the anomalous position of the heavy or commercial motor, which is permitted to have an axle weight of 840 pounds per square inch width tire on a wheel 3-ft. in diameter, while a traction-engine is only allowed a weight of 616 pounds per inch width. He gives examples of the damage caused by these heavy motor-vehicles and suggests that steps should be taken to remedy this state of affairs.

Dust and its Prevention on City Streets.

By Prof. Arthur H. Blanchard, M. Am. Soc. C. E., Consulting Highway Engineer, Providence, R. I.

PUBLIC nuisances shall not be tolerated within the city limits is a phrase to be found on all our municipal statute books and yet repugnant, dirty, dusty streets are characteristic of practically all of our American cities. Why should a people, who spend vast sums of money for public improvements which add to the comfort of mankind, submit to streets covered with dust and dirt of all kinds? One reason is that the large majority of the people of this country do not appreciate that it is economically possible to have clean and practically dustless streets and those who are familiar with cities where clean streets are the rule rather than the exception have not the courage of their convictions to make an emphatic protest to those responsible or to carry the issue to the polls if necessary. The present is an opportune time for vigorously attacking the broad problem of prevention of dust on city streets since it is slowly becoming recognized that clean streets contribute not only to the healthy condition of a city, but also play an important part in attracting capital and desirable residents. One must have a callous mind, indeed, who can drive through the streets of Dresden at any time of the day and not be impressed with the spotless, dustless condition of the streets of that municipality and feel that it is a desirable place in which to live.

Before considering the effects of dust and the methods of alleviating the nuisance caused by its presence a study of the sources from which street dust arises may be of interest. A self-evident source of dust is the mechanical abrasion by traffic of the road or street surface. It is manifest that the degree of abrasion will depend upon the amount and nature of the traffic, the kind of materials used, and the method of construction and maintenance employed. Other sources of street dust depending upon traffic are the deposition of dirt which has adhered to the wheels of vehicles coming from adjacent earth, gravel, or macadam streets, from the leakage of the contents of loaded vehicles, both in transit and while loading and unloading, and from the excrement of animals. All street dust is by no means the result of traffic. In sections where shade trees are common a source of dust is to be found in the decay of twigs, bark and leaves, while pollen, seeds and spores of various plants are further sources. Mineral matter applied to certain street surfaces to prevent slipperiness is a constant source of dust. Dust resulting from manufacturing enterprises frequently forms a very considerable part of street dust. Mills where pulverizing is carried on, textile establishments and foundries are prolific sources of dust, while soot and fine ashes from chimneys find their way to the streets. From the nature of these sources it is apparent that the composition of street dust is extremely varied and complex.

Dust exerts a considerable pathogenic influence aside from its acting as a conveyor of disease germs. Various delicate membranes are irritated by the simple mechanical action of the dust with the result not only of local inconvenience, but many times of general debility. The membranes of the respiratory organs are susceptible to this influence, especially if a person be asthmatic. The membranes of the eye are also frequently seriously irritated by dust. In the sections where the dust problem has been successfully solved physicians report a marked falling off in the number of cases of conjunctivitis.

In considering the problem of dust prevention on city streets it is advisable to classify the public ways under two general heads, business and residential streets, and to further differentiate between residential streets which are narrow, heavily shaded with trees and bordered with residences, and those streets which are more or less open.

There is one way and only one way to satisfactorily prevent dust on bituminous, cement-concrete, brick, wood block and stone block pavements, which are subjected to excessive horse-drawn vehicle traffic. That method consists of removing the dung of animals and other street refuse by hand sweeping during the day, mechanical sweeping of the streets at night, which should be preceded by sprinkling, and finally flushing with water to remove fine dust and thoroughly cleanse the surface of the pavement. Under certain conditions dependent upon the amount and character of traffic and the uses to which the street is subjected it is feasible to omit the mechanical sweeping. It must be realized that it is absolutely impossible to economically remove fine dust by either hand or mechanical sweeping. The use of the so-called dust palliatives and surface treatments on pavements subjected to heavy mixed traffic is entirely wrong in principle, as sanitary conditions require the constant removal of filth from streets and if this

is removed periodically by flushing, the effectiveness of these processes is curtailed. Again, periodical watering of pavements to lay dust throughout the day is fundamentally wrong, as the fine dust which necessitates sprinkling should have been removed.

However, bituminous, cement-concrete, brick and wood block pavements may be used on streets subjected primarily to motor car traffic and light horse-drawn vehicle traffic, such as boulevards, open intra-urban trunk lines, etc. In such cases flushing is not necessarily a prerequisite to cleanliness. Generally patrol hand sweeping throughout the day will be sufficient.

Residential streets may be built with bituminous surfaces or as bituminous pavements dependent upon local conditions. On this class of streets the traffic is usually comparatively light from the standpoint of city traffic. If such streets have a surface coat of the proper kind of asphaltic material the dung of animals and other refuse can be removed by patrol hand sweeping while the nature of the surface will be such as to absorb fine dust and render the street practically dustless.

For macadam streets in poor condition for superficial treatments or when financial conditions do not render expedient the use of surface treatments and patrol sweeping, recourse must be had to the use of palliatives, such as light oils or light tars. To attain successful results it is necessary that light products having the proper chemical and physical properties should be used in small amount periodically during the season of dust.

In slum residential districts the streets, unless subjected to heavy horse-drawn vehicle traffic, should, provided grades will permit, be constructed of waterbound macadam with a superficial coat of refined tar or as bituminous pavements with a seal coat of refined tar. The gradient, however, may require the use of an asphaltic tar compound or an asphalt for the superficial or seal coat. These forms of construction will give a sanitary surface, one from which excess dirt, dung of animals and refuse can easily be removed by patrol hand sweeping and which, during the night, can be thoroughly cleansed by flushing. It should be noted that the nightly flushing with water will add materially to the comfort of the people by perceptible cooling of the atmosphere during hot summer nights.

In closing it is paramount to emphasize the fact that economical and efficient results will only be attained by municipal ownership of the requisite plant equipment and a well-organized force of competent workmen.

Street Sprinkling in Denver, Colo.

ONE of the busiest departments of the Denver city government at this season of the year is the street sprinkling department, the employes of which are on duty two-thirds of the day in their campaign against the dust evil. The present season has been a particularly trying one, and every piece of equipment in the department is being utilized in an egort to keep the dusty streets in a moist condition. More territory is being covered by the sprinklers than ever before.

The department aims to wet the streets in an area aggregating forty square miles from twice to three times daily. The dirt streets are gone over twice a day, morning and afternoon, and the paved streets in the business section during the months of June, July, August and September three times a day. Some of the thoroughfares where traffic is heavy are sprinkled at night, in addition to their twice-daily wetting. The grounds about the City Market are also sprinkled at night so that they will be in a dustless state when the hundreds of wagons loaded with fruit and garden truck arripe during the early morning hours. Denver's area in square miles is a fraction over fifty-nine. The streets and boulevards in all but nineteen square miles are sprinkled by the sprinkling department.

The remaining portion includes the parks, the sprinkling of which is done by the park department, and certain highways that are inaccessible to the sprinkling teams, and also streets that are undergoing grading and other improvements, over which it is impossible to take a sprinkler.

The work of sprinkling is systematized in such a way that nearly every section of the city, except in the cases noted, is receiving its proper share of water daily. The city is divided into ninety-six districts, one for each of the ninety-six sprinkling teams. On the dirt streets the beat of the sprinklers averages twelve blocks twice a day for each team. The sprinkler goes up one side of the street and down the other, making one round trip in the

morning and one in the afternoon. The spray from the wagons reaches eighteen feet, and by going back and forth a thirty-six-foot street can be covered.

The capacity of a Denver sprinkler is 600 gallons. Water is taken from the city hydrants and one load will wet three blocks of streets on one side.

The sprinklers in use in Denver are of the most approved pattern. Most of them are shipped direct from factories at Austin, Ill., and South Bend, Ind. Eight sprinklers have been built at the city shops and more will be constructed there as the shops expand. All repairs are made at these shops.

The men who drive the sprinklers are paid $4.50 a day for eight hours' work, and at the same rate for overtime. They furnish their own teams. However, the city pays only for work actually performed. If there is a rainstorm, necessitating an abolishment of sprinkling for a morning or an afternoon, the drivers are docked for a whole or a half day, as the case may be. They receive their orders either from a bulletin board in front of the department's office at City Hall or by calling headquarters by telephone.

Sprinkling is carried on to some extent during every month of the year, though the force is reduced materially in the fall and winter months because as a rule streets have to be wet but once a day during these periods and one team is enabled to cover two ordinary beats.

The superintendent is provided with a runabout motor car in order that he may go over the city daily to see that sprinkling is being properly carried on. Formerly the superintendent used a horse and buggy, but it was next to impossible for him to cover the territory required for the best service by that means. Since the advent in the department of the auto and two motorcycles, which are used by the assistant and the timekeeper in making the rounds for the purpose of checking up on every sprinkler and seeing that it does an honest day's work, the efficiency of the department has been greatly increased.

During a recent water scarcity, when the irrigation of lawns was ordered stopped for several days, the street sprinkling department performed great service to the community by drawing water from Cherry creek and hauling it to the dustier streets and to many suffering lawns.—*Denver Municipal Facts.*

Sewage Disposal with Respect to Offensive Odors.

By George W. Fuller, M. Am. Soc. C. E., New York City.

Odors in Sewage Disposal Works.

BRIEF mention will here be made of some of the factors which now appear to be of importance with reference to some of the leading methods or steps in the processes of disposal of sewage.

DILUTION.

Degree of Dilution.—In 1887 Mr. Rudolph Hering recommended a dilution of 3 1/3 cubic feet of water per second, per thousand population connected with the sewers, as the basis for the design for the Chicago drainage canal. That project was put in service in January, 1900, and is now providing approximately the degree of dilution indicated by the original design. Precise data are not at hand to indicate whether or not the organic matter is provided with sufficient oxygen to allow bacterial decomposition to proceed at all times during the flow of 23 miles on an aerobic basis. But in a general way it seems that the dilution above mentioned is adequate with respect to guarding against offensive smells so far as domestic sewage is concerned. Trade wastes at Chicago, particularly from the stock yards district, seems to indicate the desirability of making the dilution somewhat greater than above stated unless such wastes are treated before entering the sewers. It is understood that during warm weather some odors are noticeable at or near the bear-trap dam at the foot of the canal. At this place, at the power plant and at the falls in Joliet, Ill., it is to be borne in mind that considerable opportunity for aeration is afforded the diluted Chicago sewage. The necessary degree of dilution as studied by the engineers of the Massachusetts State Board of Health has been found under different conditions to range from 3.5 to 6 cubic feet per second as the necessary flow of water for each thousand population connected with the sewers. These observations are based upon small streams in many cases where manufacturing wastes are a factor of importance, through the use of oxygen, which they divert from that needed for the sewage.

It is also true in some cases that deposits of sludge in mill ponds and elsewhere likewise are entitled to consideration, so that, as a general rule, it may be said that the Chicago basis of dilution for domestic sewage seems to be adequate to

guard against objectionable smells so far as domestic sewage is concerned in well-oxygenated streams where deposits of sludge are not a factor.

Dispersion.—In a great many cases suitable sewage disposal by dilution is seriously handicapped through failure to disperse the sewage adequately in the flowing stream. That is to say, some portions of the stream near the margin are grossly overtaxed with sewage with resulting putrefaction, whereas toward the center the capacity of the stream to receive sewage is but partially utilized. This applies also to sewer outlets on tidal flats at many places. The only fair and reasonable way to utilize the dilution method of sewage disposal is to provide for prompt and complete dispersion of the sewage in sufficient water so that the exhaustion of oxygen will not result. Failure to do this has done much to give this method of disposal an undeserved reputation of producing objectionable odors.

Sludge Banks.—The discharge of crude sewage into various streams results, of course, in a checking of the velocity and the consequent deposition of coarse suspended matters which form sludge banks. Where range in water level, especially on tidal flats, is such that the bottom is exposed at times, these sludge banks may putrefy and give off objectionable odors. In some cases the conditions may be such that it may be advisable to allow the great bulk of the suspended solids to flow into the diluting stream and remove them by dredging with such frequency as to prevent serious putrefaction. Combining the effect of sludge banks with inadequate dispersion of sewage in the flowing stream, it is not unusual to find that in the shallow water near the shore of quite large rivers there are objectionable odors, notwithstanding that near the middle of the river the water contains a great surplus of oxygen.

Floating Solids.—This feature does not deal so much with the question of objectionable smells as it does with the unsightly appearance of the diluting body of water, due to readily visible particles of matters entering with the sewage. Where the diluting water is fairly free of turbidity it is especially important, as is done in many cases in Europe, to consider means for the removal of the coarser solids by screens or otherwise.

Grease and Scum.—What has just been said with respect to the coarser solids applies in some measure to those fatty and oily substances which have a specific gravity lighter than water, and hence a tendency to appear upon the surface of the water into which the liquid is discharged. These substances do not relate particularly to the odor question, but rather to the question of unsightly appearance of the diluting water. They can be removed to a considerable extent with the aid of baffles and scum boards.

Protection of Fish Life.—A number of streams in this country have caused considerable trouble at times as to offensive smells due to the killing of large numbers of fish, as a result of exhausting the dissolved atmospheric oxygen in the water. This question brings up one of the mooted points at present in the disposal of sewage by dilution, namely, the safe margin of residual oxygen to allow in the water receiving the sewage. As a general proposition, the available evidence indicates that ordinary major fish may be reasonably provided for when the dissolved atmospheric oxygen in the body of the diluting water does not become less than about 33 per cent. of that necessary for saturation. The result of German investigations cited in Lunge's Technical Methods of Chemical Analysis, Vol. 1, Part II, page 386, where reference is made to the poisonous effect upon fish of 8 to 12 parts per million of hydrogen sulphide.

Residual Dissolved Oxygen.—It has recently been suggested that a margin of 75 per cent. of that necessary for saturation of the diluting water should be provided in ascertaining the proper degree of dilution of sewage. It is believed that this is seriously in error as an unqualified general proposition. It may be predicated perhaps to a considerable extent upon observations made at points where sludge banks and improper dispersion of the sewage have caused offensive conditions to arise, but which could not exist if the above features were properly carried out. The extraordinary aspect of this proposition is that it would eliminate some of the largest rivers in this country from the list of those capable of properly receiving sewage by dilution, notwithstanding the fact that such rivers after proper filtration serve as the source of satisfactory domestic water supplies. On the other hand, it is quite probable that the degree of dilution established at Chicago might have to be increased materially if certain kinds of fish life were to be satisfactorily taken care of as distinguished from guarding against putrefactive odors. On the latter score there is no question about aerobic conditions prevailing with a substantial absence of offensive smells so long as there is a small but well-defined margin of dissolved oxygen present at all times and at all places. This follows from the early discussions in this paper with respect to the fundamental principles of the oxidizing and reducing fermentations of sewage, as established at Lawrence more than twenty years ago.

REMOVAL OF SUSPENDED SOLIDS.

The extent to which it is advisable to

remove suspended matter from sewage depends largely upon the manner of its final treatment. In the case of dilution where there is ample dissolved oxygen, as above mentioned, that method of disposal calls for the consideration of the removal only of the coarser solids. Some styles of filtration, however, for reasons of economy and efficiency call for clarification to a substantial extent for the reason that it is easier and cheaper, all things considered, to filter a clarified sewage than an unclarified sewage.

The proper scope of the different devices for the removal of suspended matter and the conditions under which they may operate with reasonable freedom from objectionable smell are outlined as follows:

Grit Chambers.—These arrangements comprise very small compartments, in which coarse matters may be removed by sedimentation. As the term is ordinarily applied, it refers to the deposition of road wash in connection with a system of combined sewers. If these basins are made too large they add complications on account of having too much organic matter in the deposited solids. A reasonable allowance is to provide a velocity ranging from 6 to 12 inches per second, which corresponds to a sedimentation period of only a very few minutes. Naturally the sewage after passage through such a basin contains substantially its full quantity of organic matter, and hence the putrescibility of the sewage is affected but slightly. In connection with dilution methods it is sometimes better, however, to remove this coarse matter in basins rather than to have to dredge it from slips and flats after it has been deposited in the body of the diluting water. Where works of artificial construction involving fairly complete purification are installed, it is frequently found cheaper to remove the suspended matter of a mineral nature as a preliminary step rather than to allow it to become mixed with the suspended organic matter which needs more careful treatment when guarding against odors.

Screening.—Coarse screens are of importance in protecting pumps in plants where pumping is required. In the case of disposal by dilution, screening is frequently desirable to remove unsightly solids from the sewage. The position of screens in connection with filtration plants is now in an unsettled state, particularly with regard to fine screens. It goes without saying that the solids which are capable of being removed by screens should be taken care of in a sanitary way without producing offensive smells regardless of the detail of procedure. On this basis it becomes a question of determining whether fine screens afford a cheaper and better way of treating the solid matters than do settling tanks with suitable baffles and scum-boards. The final answer to this question can scarcely be given from the present evidence. In a general way the question of economy is an important one and varies with the size and local features of the works. For large plants mechanically-operated screens have a considerable field of usefulness, whereas the cost of maintenance frequently precludes the use of screens for very small plants. The disposal of the screenings is an item of considerable expense unless they can be freed of water so that they can be put under a boiler of some convenient power plant or taken to a city incinerator. Disposal by burial affords good results during the warmer seasons of the year with good management. In northern climates burial is not feasible during the winter and accumulations of screenings sometimes give offense in the spring before the winter accumulations are finally disposed of. Incinerating plants for screenings alone require considerable fuel, but, excluding the item of expense, this is a suitable way of disposing of the screenings without local offense.

Scum Boards.—There is considerable room for improvement in arranging scum boards or baffles so as to retain suspended matters which float upon the surface of the sewage, as it passes through basins for sedimentation or other purposes. In small plants, as already intimated, it is quite likely that screens may be advantageously eliminated if at frequent intervals the surface accumulations are thoroughly removed and disposed of in a satisfactory manner.

Sedimentation.—Depending upon the strength of the sewage and the size of the sedimentation basin, it is perfectly feasible to remove from 50 to 75 per cent. of the total suspended matter in sewage and about one-half of this percentage of the total organic matter as measured by ordinary laboratory methods. Reduction of putrescibility, however, according to Hoover's tests at Columbus, is only about 80 per cent. as great as is the removal of total organic matter. As regards freedom from odors, it is necessary to prevent putrefaction in the chamber in which sedimentation occurs. Properly speaking, this applies to the surface of the liquid, and to the deposits upon the walls and particularly to those deposits which appear upon the floor of the basin and are ordinarily spoken of as "sludge." This sludge disposal question is by far the greatest single problem in connection with sewage purification, and with ordinary sedimentation basins the quantity amounts to some 5 to 7 cubic yards per million gallons of sewage treated, with 90 per cent. of water in the sludge. Where

chemicals are employed to facilitate clarification by sedimentation, the removal of suspended matter reaches from 80 to 90 per cent., and that of the total organic matter ranges from 50 to 55 per cent. The amount of sludge is about double that obtained with plain sedimentation or even more where the percentage of water is very high. With these devices freedom from odor is also predicated upon cleaning at sufficiently frequent intervals to guard against putrefaction.

DISPOSAL OF SLUDGE.

As already stated, this is the great problem of sewage disposal, and reference will be made briefly to the principal methods of disposal of sludge and particularly to the latest arrangements for the septicization in two-story tanks of the Emscher type.

Sludge Beds.—The fairly fresh sludge removed from plain sedimentation chambers is frequently applied to special sludge beds, where the thick liquid becomes a solid mass, due to the removal of water, partly by evaporation and partly by percolation through the material to which the wet sludge is applied. Generally there is removed with the sludge and scum considerable fairly clear liquid which lies between the bottom deposit and the surface scum. The organic matter is in a state where it readily putrefies and odors of putrefaction are liable to result in the old-fashioned sludge bed. After the material has lost a part of its water it is sometimes carried away by farmers to be utilized for fertilizing purposes, but this is not a procedure that can be relied upon. Taken altogether, the sludge bed is quite an unsatisfactory method on a large scale of disposing of sewage sludge from the modern standpoint. Where it is applied with moderate success its operation is usually confined to the cooler seasons of the year, when the sludge may become thoroughly dried and removed before warm weather sets in.

Sludge Lagoons.—This procedure is very similar to the sludge bed, except that dikes are employed so as to permit of storing the sludge to a much greater depth than in the ordinary sludge bed. In some places, as at Reading, Pa., this has worked out satisfactorily for several years. The sludge disappeared in volume to the extent of about 50 per cent. Objectionable odors are noticed at times within 100 to 200 feet of the lagoon, but are not noticeable to a greater distance, according to present evidence. Whether this would be true with the sludge from all plants is, of course, uncertain. Covers for lagoons have some merit as compared with open lagoons, but except for unusual conditions their utility is far less than the arrangements like the Emscher tank.

Sludge Trenches.—Sludge trenches, when covered, allow sewage to become well rotted and with the odors greatly minimized due to their passage through the material overlying the trench. For small plants this process seems to have much merit, especially in the northern climates. For large plants, however, it does not afford competition with the Emscher tanks.

Dilution.—This method is rarely applicable on account of the peculiar conditions which are required in order to justify its use. Its applicability relates to conditions where sludge may be allowed to accumulate in tanks for months at a time and then be discharged at time of flood flow into a sizable river. Its practical merit depends upon whether the storage facilities for sludge for some months at a time are a simpler and cheaper arrangement than devices for the removal and disposal of sludge at frequent intervals. A dilution of sludge of about 1 to 800 seems to provide satisfactory results according to observations at Columbus, Ohio, in the Scioto river when it is in flood.

Septicization in One-Story Tanks.—The ordinary septic tank is essentially a plain sedimentation tank operated so that the sludge on the floor of the tank, with whatever scum accumulates on the surface, is removed only at very infrequent intervals. This is a patented process covered by the Cameron patent (No. 634423), of which the following claims were adjudicated as patentable in the Saratoga Springs case:

"(1) The process of purifying sewage which consists in subjecting the sewage under exclusion of air, of light and of agitation to the action of anaerobic bacteria until the whole mass of solid organic matter contained therein becomes liquefied, and then subjecting the liquid effluent to air and light.

"(2) The process of liquefying the solid matter contained in sewage, which consists in secluding a pool of sewage, having a non-disturbing inflow and outflow, from light, air and agitation, until a mass of micro-organisms has been developed of a character and quantity sufficient to liquefy the solid matter of the flowing sewage, the inflow serving to sustain the micro-organisms, and then subjecting said pool under exclusion of light and air and under a non-disturbing inflow and outflow to the liquefying action of the so cultivated micro-organisms, until the solid organic matter contained in the flowing sewage is dissolved.

"(3) The process of liquefying the solid matter contained in the sewage, which consists in secluding a pool of sewage having a non-disturbing inflow and outflow, from light, air and agitation until a mass of micro-organisms has been developed of a character and quantity suffi-

cient to liquefy the solid matter of the flowing sewage, the inflow serving to sustain the micro-organisms, then subjecting said pool under a non-disturbing inflow and outflow and under exclusion of light and air to the liquefying action of the so cultivated micro-organisms until the solid organic matter contained in the flowing sewage is dissolved, and then subjecting the liquid outflow to an aerated operation.

"(4) The process of liquefying the solid matter contained in sewage, which consists in secluding a pool of sewage having a non-disturbing inflow and outflow from light, air and agitation until a mass of micro-organisms has been developed of a character and quantity sufficient to liquefy the solid matter of the flowing sewage, the inflow serving to sustain the micro-organisms, then subjecting said pool under a non-disturbing inflow and outflow and under exclusion of light and air to the liquefying action of the so-called micro-organisms until the solid organic matter contained in the flowing sewage is dissolved, then subjecting the liquid outflow to an aerating operation, and then to a filtering operation.

"(21) The process or liquefying the solid matter contained in sewage, which consists in secluding a pool of sewage having a non-disturbing inflow and outflow from light, air and agitation until a thick scum is formed on the surface thereof and a mass of micro-organisms has been developed of a character and quantity sufficient to liquefy the solid matter of the flowing sewage, the inflow serving to sustain the micro-organisms, and then subjecting said pool under the cover of said scum and under a non-disturbing inflow and outflow to the liquefying action of the so cultivated micro-organisms until the solid matter in the flowing sewage is dissolved."

During the Saratoga litigations it was understood by all concerned that the life of the Cameron patent would expire in November, 1909, which was the 14-year life of British patents, dating from the time of issue of the Cameron patent in Great Britain. Since that time the question has arisen, with respect to the Cameron patent and others of foreign origin, as to whether the International treaty of Brussels in 1903 should be made retroactive or not. If made retroactive the Cameron patent would have the American life of 17 years from the time of its issue in the United States, that is, it would continue until October 3, 1916. This question is not yet finally adjudicated. It is understood that the Cameron Septic Tank Company has received an unfavorable decision in the lower Federal Courts in their suit brought against Knoxville, Iowa, but that an appeal was taken to the U. S. Supreme Court.

The single story septic tank has its warm advocates and its strong opponents. Likewise it has merits and demerits. Briefly, its advantages are as follows: The first point results from the clarification due to sedimentation although there is no reason to believe that the septic effluent is any easier to purify than is the effluent of plain sedimentation tanks giving equal clarification. The mixing accomplished in the tanks is of some aid in making the work more uniform for filters and other following treatments. As to sludge, there is some liquefaction and gasification of suspended organic matter. The advantage of this consists in the reduced volume, permitting a much longer period between cleanings than is possible with plain sedimentation tanks. Removal of sludge under some circumstances may occur only once in four or five years or so, where the sewage is only of domestic origin, although it may be necessary to clean the tanks once a year or oftener. Septic sludge under some circumstances is considered easier to handle than is the sludge from plain sedimentation tanks, and this is probably true if the decomposable organic matter is well rotted out or humified.

The disadvantages of a single story septic tank consist principally in the fact that the detention of the sewage in the tanks is under such circumstances that the dissolved oxygen in the effluent is exhausted and that putrefaction has commenced. This means that fresh sewage is not to be found in the septic effluent under ordinary circumstances, and consequently there is a greater likelihood of putrefactive odors. The products of putrefaction of the sludge arise through the flowing liquid and even in closed tanks some objectionable odors become diffused in the neighboring air. Similarly, the products of putrefaction cause some bacterial products, commonly known as toxins, to enter the flowing liquid and under some circumstances to interfere with the subsequent putrefaction. Gas ebullition with fresh sewages frequently lifts suspended matter so as to form a heavy scum, the organic matter of which is not septicised. This gas ebullition also lifts sediment from the bottom and in this way sometimes produces very serious filter clogging unless such sludge in the septic effluent is removed by devices which at best are expensive. The stirring up of the sediment layer sometimes causes a septic tank to be put out of service and perhaps cleaned when it is very inconvenient to attend to such cleaning. If it is not cleaned the septicization or the complete rotting out of the unstable portions of the suspended organic matter does not proceed reliably so as to make an inodorous sludge. The reasons why septicization in a tank that is standing idle does not pro-

ceed seems to be partly due to the absence of incoming food for bacterial growth and partly to the dying off of certain desirable kinds of bacteria due to the products of bacterial growth. The result of this is that some unstable organic matter remains in the sludge which is not humified or reduced to an inodorous product that may be satisfactorily discharged on open beds. Practice shows that stable organic matter and mineral matter in suspension are not liquefied. When this style of tank is working to best advantage as regards the complete rotting of the sediment layer there still is to be contended with at times of cleaning the disposition of the liquid contents of the tank, that is, the sewage between the sediment at the bottom and the scum at the top, as well as the fact that the scum is ordinarily not well septicized. These factors add much to the odor under some circumstances. Covers for single story septic tanks tend to minimize the odors noticeable at a distance from the plant apparently through mixing of gases and the prevention of wind and rain from promoting the transmission of odoriferous substances of a gaseous or volatile nature.

Septicization in Two Story Tanks.—These tanks have recently been referred to as the Imhoff or Emscher tanks. They have their origin from a scientific standpoint in certain tests made a dozen years ago by Mr. Clark at the Lawrence Experiment Station in the septicization of sludge in compartments separate from the sedimentation tank itself. These studies resulted as a first practical outcome in the so-called Travis Hydrolitic tank at Hampton, England. These tanks have horizontal partitions or baffles which separate the upper sedimentation chamber from the lower digestion chamber in which septicization takes place. The partitions have a steep slope which allows the deposit or sediment to slide through a slot at the bottom into the digestion chamber substantially as fast as it appears in the sedimentation chamber below. The lower edge of one of these partitions extends beyond the edge of the other partition. In this way the gas resulting from the septicization in the lower compartment cannot pass through vents at the side. The principal difference between the Travis tank and the Imhoff or Emscher tanks is that in the former a certain portion, say 20 per cent., or so, of the sewage passes regularly through the digestion chamber. In the Imhoff tank, however, none of the contents of the digestion chamber are allowed to mingle with the effluent of the sedimentation chamber above.

These two story tanks seem to possess all the advantages of a single story tank and especially are they superior in that they allow a settled effluent to be obtained which is substantially as fresh as the unsettled sewage reaching the plant. In other words, a settled sewage is obtained which is at all times free from the results of septicization as to putrefactive products and the sludge of the digestion chamber. The sludge is freed from the sedimentation basin automatically and continuously and it is not necessary in removing the digested sludge to deal with a sedimentation chamber full of fresh sewage, perhaps with more or less scum upon it. In brief, it is possible to obtain a sludge which in a suitably designed tank has remained in the digestion chamber for a sufficient number of months to become so thoroughly rotted out that it is well humified and quite inodorous. Furthermore, a sludge can be obtained under ordinary circumstances from these deep tanks such that its removal and its separation from water is much easier than with ordinary septic tank sludge. The deep tanks under the conditions as tested for some three years or so in the Emscher district of Western Germany seem to be unusually free from odor as compared with the single story tanks or even two story tanks in which some sewage constantly passes through the digestion chamber. This seems to be due to a number of factors, among which may be mentioned the greater coefficient for the absorption of gases by liquids under a greater depth and pressure, and also the mixing which seems to take place. This mixing seems to promote the absence of large bubbles rising vertically so as to make their escape into the atmosphere of the surface. Perhaps, the latter is also due in part to the additional opportunity afforded for combination of gases with the liquid in the chamber.

The disadvantage of septicization in two story tanks is that the tanks are more expensive and difficult to build than one story tanks, particularly if the lower portions are to be built in rock, ground water or quicksand. The scum of floating matters on the surface of the liquid in the sedimentation chamber require frequent and careful attention to guard against odor. Under some circumstances this may be true of the scum which appears on the surface of the gas vents connecting with the digestion chamber. The sludge cannot be removed and dried on thin gravel beds in an advantageous way during the severe winter weather in the northern climate, and hence it is necessary to build the digestion chambers under some conditions that are very large. The process does not prevent sulphuretted hydrogen formation in the sludge, but with good management it seems to minimize the escape from the digestion chamber of objectionable gases into the surrounding atmosphere.

Causes and Effects of Public Utility Commissions.*

By J. H. Roemer, Madison, Wis.

WITHIN the last few years a somewhat general demand for the enactment of laws creating public service commissions, with power to regulate all public service corporations, has arisen in many states. This seems to be the natural and logical sequence of the regulatory measures respecting railroads and other common carriers now in effect in the nation and in most states. Whatever may be the views and attitude of those who manage and direct the affairs of such corporations in respect to the subject, the time has arrived when state surveillance of all corporations and individuals engaged in public callings is essential to the common weal. Unfortunately, however, the real reasons justifying such action on the part of the state have not always been advanced or been potent to create public sentiment favorable to such legislation. Much of the agitation has been, and is, based upon superficial and inconsequential grounds, and emanates from a somewhat general conviction that most public service corporations are exacting exorbitant charges from the public for the services rendered, and are concealing the fact by paying moderate dividends upon a fictitious capitalization. While the view thus entertained is grossly exaggerated, it cannot be successfully controverted that over-capitalization, coupled with imprudent management, has frequently been a menace to the proper performance of the public functions of such corporations according to the full measure of duty imposed upon them by laws as well as by voluntary contractural provisions. In such instances the eagerness of managements to demonstrate their administrative ability, by declaring dividends upon stock, results in the curtailment of operating expenses to such a degree that the rendering of efficient service becomes impossible, also in the neglect of proper maintenance of the property and in the failure to make provision for depreciation. Thus the public, on the one hand, is made to suffer by reason of poor service, and the bondholders, on the other hand, are likely to suffer by reason of the diminution in value of their security. Under such circumstances, when replacements become necessary to the continuance of operation, they can be provided only by the issuance and disposal of additional securities. Thereby the capital account becomes charged with expenditures that should have been taken and saved from the operating revenues.

Much hostility also to the managements of public service corporations has been engendered by negotiations between municipalities and such corporations for the granting of franchises, which negotiations have not always been free from the suspicion that improper methods have been employed to induce those representing the public in the transactions to consent to terms and conditions detrimental to the public interest. As a result public service corporations are more or less a factor in local politics, and the manner of their regulation is often an issue in local political campaigns. This is unfortunate, both for the public and the corporation, for the legitimate interests of both in the public utility are jeopardized. In the conflict neither seems to recognize its proper relation to the other, nor to realize that the effective regulation of a public service corporation, in respect to the performance of its public function, cannot be had by means of ordinances or contracts. As franchises are usually for a long term of years, it is obvious that the attempt to prescribe in detail the obligations of the public utility to the public, or *vice versa*, during the life of the franchise, must of necessity fail. No one can foresee in a quarter century the changes in the arts embraced in public utility service, the development and necessities of the communities served or the requirements of the utilities to perform their functions under conditions which must necessarily change in the progress of time. Less than two decades ago I saw in my home city an electric power plant just completed which was regarded the most modern and efficien plant of the kind in existence. Its capacity was considered enormous. Engineers and others interested in the advancement of the art of generating electric energy came from all sections of the country to view this plant, which was equipped with the most modern appliances.

For the past few years this plant stood idle most of the time, serving merely as an auxiliary in emergencies. It is but an evidence of how rapidly the art has advanced and rendered obsolete the most

*From a paper before the Illinois Gas Association.

expensive appliances. The advancement in the art of telephony within a very few years is little less than marvelous. Costly equipments have been scrapped and the entire systems reconstructed to meet the public requirement for the best service. In other utilities the changes have not been so marked, and equipment has become more or less standardized; but who can tell what a quarter of a century may bring forth in any art or science? To meet the conditions as they arise is the only way that the best interests of the public and utilities can be conserved in the matter of rates and service. Any franchise which attempts to anticipate the needs of the future in these respects, and provide for the same, which most franchises do, sooner or later becomes inadequate to satisfy existing requirements and prolific of contention between the community and the utility. Even where the right to fix rates and establish standards of service from time to time has been reserved to common councils in such franchises, intelligent action has been rare. The expenditure of large sums of money by the larger municipalities, to ascertain all of the essential facts necessary for intelligent and lawful action on the part of the common councils invested with power to establish rates, has more frequently been wasted than profitable, as the facts thus acquired have generally been ignored and action taken which was either prompted by prejudice or based upon ulterior political considerations. Litigation necessarily followed, which involved the further outlay of large sums of money on the part of the public and the utility, all of which in the end had to be paid by the taxpayers and patrons of the utility.

It was with a view of placing public utilities upon a sound basis and eliminating all unnecessary friction between the public and such concerns, due to causes arising from ignorance of the economic status of public utilities and their moral and legal relations to the public, that the Wisconsin Public Utilities Law was framed and enacted. The economic features of this law, which are fundamental in its structure, are the result of exhaustive study and investigation and consideration given to the subject by Prof. John R. Commons, University of Wisconsin. After more than three and a half years' administration of the law the wisdom of the sound, economic basis upon which the law was constructed has been demonstrated, and the results obtained from its operation have been generally satisfactory to the public, the utilities and the investors in the securities of such concerns.

Among the more important provisions of the law are those relating to valuation, uniform accounting, standard units of products or service, publicity of rate schedules, fixing of rates and regulations, indeterminate franchises and the purchase of public utility plants by municipalities. It will be impossible to consider at length the effects of all these various provisions without extending this discussion to an inappropriate length. However, reference will be made to the more important features of the law that its general effects may be more fully appreciated.

The law requires the Commission to value "all the physical" property and "all the property actually used and useful for the convenience of the public" of every public utility subject to its provisions. Over 1,000 public utilities in the State are under the regulation of the Commission. Of these the Commission has appraised to date about 100. The method of valuation adopted by the Commission, as shown by its decisions, is a subject of such magnitude that it cannot be touched upon here. Suffice it to say that no appeal has even been taken by either a utility or a municipality from any valuation made by the Commission, and that the question of capitalization is no longer capable of seriously inflaming the public mind in any community in Wisconsin.

Very soon after the enactment of the law preliminary steps were taken by the Commission toward carrying into execution those provisions relating to the establishment of standards for the quality of service rendered by the public utilities companies, and to the enforcement of such standards in a manner consistent with the spirit of the law. It was realized from the first that the proper administration of the provisions of the law relating to standards of service would necessitate the establishment of a circulating laboratory equipment, to be used in fixing the legal units and standards, and in putting the same into practice on a permanent and uniform basis throughout the State. After some preliminary discussions and conferences an agreement was entered into whereby the extensive laboratory facilities of the University of Wisconsin were, as far as practicable, made available for the purpose of the Railroad Commission, with the understanding that there should be reciprocal use of the instrumental equipment to be purchased subsequently by the Commission. This arrangement proved especially advantageous to the Commission, since it afforded an opportunity to act with deliberation in choosing the instrumental equipment ultimately required in handling the work on a large scale. Following closely upon the agreement with the University authorities above mentioned, the co-operation of the United States Bureau of Stand-

ards at Washington was solicited with the further result that definite arrangements were made whereby the standards used in the administration of the Wisconsin public utilities law shall, as far as practicable, be subject to verification and control with reference to the official government standards at Washington.

A further instance of important co-operative work during the preliminary period of developing standards, and in the selection of testing equipment best suited to the demands of the situation in Wisconsin, consisted in the appointment by the American Gas Institute of a special committee on gas calorimeters. One of the members of this committee was Prof. C. F. Burgess, who is in charge of the gas and electric service inspections for the Commission. Part of the work of that committee was handled by members of the Commission's staff, and the results of these investigations were made immediately available for use by Wisconsin's gas plants.

Gas and Electric Service Inspections.—The arrangements above outlined, it should be explained, while intended to apply to any phase of the question of units or standards which might arise under the public utilities law, were naturally of more immediate use to the Commission in connection with gas and electric service.

A preliminary canvass of current practice, relating to standards of gas and electric service elsewhere in the country, threw but little light upon the question of fixing the proposed standards. In fact, it was at once realized that a special field study of the services actually rendered by the Wisconsin gas and electric companies would be a necessary preliminary to the intelligent formulation of the contemplated standards of service and the rules governing the same. In undertaking these field studies it became necessary to provide special field equipment which early took definite form as "traveling laboratories." After some progress had been made in this preliminary investigation, the results were thrown into shape, to be presented at a general conference at Madison in March, 1908. At this informal hearing the owners and operating officials and experts of the various gas and electric companies of the State were given an opportunity to express their views in relation to the proposed standards of service. The programme or outline of these discussions included the following points:

GAS SERVICE.

I. Accuracy of meters:
   1. Method of testing.
   2. Limit of error allowable.

II. Calorific valve:
   1. Importance.
   2. Method of testing.
   3. Minimum value.
   4. Variation allowable.
   5. "Gross" or "net" values.

III. Candle power:
   1. Importance.
   2. How defined.
   3. How measured.
      a. Kind of photometer.
      b. What standard.
      c. What kind of burner.
   4. Minimum value.
   5. Variation allowable.

IV. Composition:
   1. Restriction as to impurities.
      a. Ammonia.
      b. Sulphur—total.
      c. Sulphur as HS.
      d. Diluents.

V. Installation:
   1. Safety.
   2. Adequacy.

VI. Pressure.

ELECTRIC SERVICE.

I. Accuracy of meters:
   1. Method of testing.
   2. Limit of error allowable.

II. Uniformity of voltage:
   1. Allowable variation from normal.
   2. Interruptions.

III. Lamp efficiency:
   1. What provisions for lamp renewals.
   2. Voltage.

IV. Installation:
   1. Safety.
   2. Voltage Limits.
   3. Adequacy of wiring.

In addition to those directly representing Wisconsin interests, there were present at this conference gas and electrical experts from other States, also an official representative of the Government Bureau of Standards. The proceedings of this conference were supplemented, upon request by the Commission, by communications received from those in attendance and from other sources. In the light of the information thus gathered, and further important data brought together through the means of additional tests of service throughout the State, a preliminary set of rules relating to gas and electric service was formulated by the technical staff serving the Commission. After further conference and discussion, these rules were officially adopted by the Commission, July 24, 1908, to become effective three months thereafter (see decision No. U-21, "*In re* standards for gas and electric service in the State of Wisconsin").

EDITORIAL COMMENT

Cost Accounting and Contracting Practice.
Water Waste. Chicago Paving Investigation.

COST ACCOUNTING AND CONTRACTING PRACTICE.

The series of practical papers on "Contracting Practice" which is at present appearing in these pages has given rise to some discussion among contractors who are seeking to better their methods. Much has been written regarding more efficient methods of handling details in contract work, and volumes have been published giving figures of cost gathered from specific jobs and tabulated, and published to be later applied on other and perhaps dissimilar work. The general dissatisfaction caused by the following of the so-called cost data set forth in this class of matter leads the average contractor to feel that his problems are unique and that the methods and costs offered are inapplicable to them.

The contractor has learned, through experiences, that the large volumes of cost data which are presented to him periodically are not directly applicable to any particular job, except the one upon which they were originally used. He has recognized also that the discussions on "Efficiency" or "Efficiency Engineering" are hopelessly beyond his grasp and he hasn't the time to pick out the basic thoughts and apply them to his own work.

In the series of articles by Mr. Moore no attempt has been or will be made to offer any iron-clad "rules of conduct" or to tell the contractor the costs of materials or labor in specific instances. It is the purpose of these articles to present the common-sense methods which have been used and found valuable in actual practice. The tabulated forms and data sheets shown are not of such a complicated nature as to require the contractor using them to have a store room filled with blank forms; but they are of such a nature that the average contractor may in a few minutes rule up a sheet to answer the purposes advocated, the same as obtained in the larger offices by the use of carefully printed form sheets.

Some sewer or pavement contractor may glance hurriedly at one of the plates shown and note perhaps that the items noted are for building construction. This may lead him to think that the forms are useless for his purpose and inapplicable to his work. Such, however, is not the case, as will be noted on more careful consideration. The divisions and column headings used are general in their application and may be used with equal value upon any kind of general contracting work. Building construction is used for illustration simply because of the uniformity of items.

Mr. Moore has kindly offered to suggest, in response to inquiries, either personally or through MUNICIPAL ENGINEERING, answers to any specific questions regarding the adoption of his methods or the use of his tabular forms in particular instances. His experience covers a wide range of contract work, including practically all branches of municipal work, building construction, railroad construction, industrial and public building construction, bridge work and hydro-electric development.

A careful study of methods in work, including over one hundred and fifty contracts, enables Mr. Moore to appreciate the problems of the average contractor and to offer practical, common-sense methods for handling their work.

WATER WASTE.

Special attention is called to the article in this number of MUNICIPAL ENGINEERING on the Memphis investigation of the waste of water, because it contains many points of interest which may not

appear on casual reading. For this reason the article is printed in full as it appears in the annual report of the Water Commissioners of Memphis, the work having been done and the report prepared under the direction of Carl E. Davis, the efficient resident engineer of the plant. One or two points may be mentioned to show what can be found in the data given if one will hunt for what he wants.

The difference in the consumption of water by white and colored people is quite marked. The following table shows this as to metered water:

	Consumption (Gals.) by		
District.	Total	White	Colored
1	28.0	33.2	17.6
2	19.1	21.0	14.2
4	14.8	16.0	11.7
5	23.0	48.0	18.0
6	22.0	25.0	18.0

The character of population other than color does not have so marked an effect upon the consumption, as shown by the above supplemented by the following: District No. 1 has a first-class residential district along its north and east sides, a small manufacturing district and a large remainder of thrifty property owners with good plumbing. About one-third the population is colored. The second district is almost entirely middle-class residences. Population is about 28 per cent. colored. The fourth district has sawmills and lumber yards and good suburban residences. About 20 per cent. of the population is colored. The fifth district is largely a colored tenement district, nearly 87 per cent. colored population, and there are but 174 white persons using metered water. The sixth district is perhaps half a poor class of rental property and half good residences, not quite 28 per cent. colored population.

The consumption of water in each district, of metered water and unmetered water, and the per capita consumption where possible to compute it are shown in the table in the article referred to. The unmetered consumption includes not only the water used by consumers on flat rate, but also the leakage, water used for public purposes, water not paid for, etc. The differences between the consumption per capita of consumers using metered water and of the total population of the districts are enormous, but the figures are not comparable for the reasons noted. The paper shows the results of the reduction of leakage, but it does not make any estimates of the water used by business and manufacturing purposes not metered, for public purposes, or donated, so that the actual private consumption of water can not be approximated from the figures in the report. Undoubtedly there is much waste in all these directions and it is very probable that an investigation of the unmetered water would result in more saving than that of the metered water and the leakage in mains and services is effecting. This latter saving ranges from 5 to 43 per cent. in the various districts, averaging 16 per cent. for the part of the city covered by this investigation.

Those considering the question of waste will find the points suggested and others worthy of careful study for the light the information given may throw on their own problems.

CHICAGO PAVING INVESTIGATION.

The Chicago Bureau of Public Efficiency has been conducting for several months an investigation into the specifications for and methods of construction of pavements in that city under the efficient supervision of its chief engineer, A. J. Hammond, M. Am. Soc. C. E., and advice of Samuel Whinery, M. Am. Soc. C. E. The results of this investigation have just been published in a 40-page booklet which can probably be obtained of the Bureau on application to its office, 900 Masonic Temple.

The report proper is divided into eleven subdivisions.

It first pays its respects to the conventions of the Association for Standardizing Paving Specifications, particularly to the star-chamber methods of the New York convention. The lines were drawn fully as closely as the report describes, Mr. Hammond, the representative of the Bureau, and the writer, an accredited representative of the committee on standard specifications of a sister organization, as well as others, being refused opportunity

to listen to the deliberations of committees and appearance in any manner before that on wooden blocks, of which Mr. Tillson of New York was chairman.

Some modifications in the Chicago specifications are recommended, but the adverse criticisms in the report are principally with respect to the character of the workmanship and the inspection of subgrade, curbing, combined concrete curb and gutter, concrete, asphalt pavement, granite block pavement, creosoted wood block pavement and brick pavements. The reason for the defects observed in the work is discussed under the heading of inspection, and the great value of statistical data on traffic, wear of the various pavements, laboratory tests of materials, etc., is clearly shown, as well as the absolute dearth of such material in the reports and records of the city departments.

The principal subject of discussion in the report is creosoted wood block pavement and many defects in the standard specifications adopted by the city of Chicago from the Association for Standardizing Paving Specifications are considered in detail. These include the specification for kind and quality of timber, although the quality of the blocks actually laid in Chicago during the period of the investigation was found to be satisfactory. There is a full discussion of the relative value of creosote and tar oils as wood preservatives, the value of creosote being clearly shown, while the value of the tar oils is as yet not demonstrated. The increase in specific gravity of the material for treating wood blocks up to the latest specification, which almost entirely cuts out creosote as an ingredient, is sketched and definite and unequivocal statements of the practical impossibility of fulfilling the specification except by the use of coke-oven tar are made. The method of cutting out water-gas tar is also shown. The permanence of the effect of coal tar creosote is shown by the results of government tests which show that creosote of proper quality is not subject to excessive evaporation. The desirability of having a material for treating blocks which is water-proof is also considered, and the possibility of using water-gas tar for this purpose is shown in case the specifications did not require a pure coal tar product. The trouble from "bleeding" with blocks treated by the new process is described and some explanations of the phenomenon are offered, that preferred being that "under the influence of heat and its expansive effect on the blocks, augmented possibly by the evaporation of the moisture imprisoned during the steaming process hereinbefore referred to, the tar is forced out of the pores of the wood and forms a coating, whereas, if creosote oil alone is used, the slight exudation is not sticky and objectionable, as is the tar." The experiences in Chicago under the new specifications and in Indianapolis, which has returned to a creosote oil specification after some years use of a mixture of creosote and heavier tar oils, are cited in support of this statement. The writer corrolorates the statement regarding Indianapolis, from observation of a street under construction, which has "bled" to some extent under the recent hot weather, but is not sticky and is kept in reasonably satisfactory condition during the construction period by the use of sand and dust.

The report brings together all the criticisms which have been made of the actions of the Association for Standardizing Paving Specifications, makes them definite by means of names, dates and places, and applies them to the Chicago conditions in a manner which is clear and convincing and which, if based on incorrect information, must be answered by the supply of correct data. It can not be answered by the indefinite statements made by the committee of the Association referred to as to the possibility of independent supplies of material, nor can the specifications stand the attack upon their sufficiency and correctness without more defense than the simple reiteration of their provisions, which is the only reason for their existence which has yet been offered.

MUNICIPAL ENGINEERING has published within the last year most of the information given in the report, but commends to its readers the concise, clear and logical statements and arguments contained in it, which will be of great value to every one interested in paving, particularly in wooden block and asphalt paving.

THE QUESTION DEPARTMENT

Books on Concrete Construction.

Please send us a list of publications on concrete construction.

B. B., Eldorado, Iowa.

The best descriptive list of books on concrete construction is one published some years since by the book department of *Engineering News,* New York. It contains an article on literature concerning concrete and classifies the books under reinforced concrete, cement and concrete, special applications of cement and concrete, concrete blocks and artificial stone, general books in the field, other books containing more or less on concrete, foreign books except English, and trade publications.

Following is a fairly complete list of the books now in the market, including those in the above named list and others, arranged alphabetically by author's name in case name is available.

Andrew's "Practical Reinforced Concrete Standards for the Designing of Reinforced Concrete Buildings." 46 pp., $2.

Associated Portland Cement Manufacturers' (of England) "Every Day Uses of Cement." 148 pp.

Association of American Portland Cement Manufacturers' "Competitive Designs for Concrete Houses of Moderate Cost." $1.

Association of American Portland Cement Manufacturers' "Directory of Portland Cement Manufacturers of the United States." 100 pp., $1.

Atlas Portland Cement Company's "Concrete Country Residences." 94 pp., $1.

Baker's "Cement Worker's Handbook." 86 pp., 50 cents.

Baker's "Treatise on Masonry Construction. 568 pp., $5.

Balet's "Analysis of Elastic Arches." 315 pp., $3.50.

Beery's "Portland Cement Sidewalk Construction." 27 pp., 50 cents.

Bellinger and Lewerenz's "Expansion and Contraction in Concrete Structures." 32 pp., 25 cents.

Black's "Artificial Stone, Terra Cotta, etc." 92 pp., 25 cents.

Black's "Concrete." 94 pp., 25 cents.

Block, Concrete." 30 pp., 35 cents.

Blocks, Concrete. 32 pp., 25 cents.

Boynton and Mitchell's "How to Use Concrete," superficial and inaccurate. 232 pp., $1.

"Brayton Standards for the Uniform Design of Reinforced Concrete." 110 pp., $3.

Brown's "Directory of American Cement Industries. 682 pp., $5.

Brown's "Handbook for Cement Users." 378 pp., $3.

Buel and Hill's "Reinforced Concrete." 499 pp., $5.

Burnell's "Limes, Cements, Mortars, Concretes, Etc." 136 pp., 60 cents.

Butler's "Portland Cement, Its Manufacture, Testing and Use." 406 pp., $5.

Byrne's "Inspection of the Materials and Workmanship Employed in Construction." 550 pp., $3.

Cain's "Theory of Steel Concrete Arches and of Vaulted Structures." 215 pp., 50 cents.

Calcare's "Cement Users' and Buyers' Guide." 75 cents.

Cement Industry, The, descriptions of plants. 253 pp., $3.

Le Chatelier's "Experimental Research on the Constitution of Hydraulic Mortars." 128 pp., $2.

Clarke's "Architects' Handbook on Cements," a trade publication. 96 pp., $1.

Cluss's "Mortars and Concretes of Antiquity and Modern Times." 25 cents.

Considere's "Reinforced Concrete," translated by L. S. Moisseiff. 242 pp., $2.

Cummings's "American Cements." 299 pp., $3.

Davis's "Portland Cement." 138 pp., $2.

Dibdin's "Lime, Mortar and Cement, Their Composition and Analysis." 227 pp., $2.

Dobson's "Foundation and Concrete Works." 120 pp., 60 cents.

Dodge's "Diagrams for Designing Reinforced Concrete Structures, Including Diagrams for Reactions and Strengths of Steel Beams." 104 large pp., $4.

Douglas's "Practical Hints For Concrete Constructors." 60 pp., 25 cents.

Dunn. See Marsh.

Eckel's "Cements, Limes and Plasters." 712 pp., $6.

Eckel's "The Portland Cement Industry From a Financial Standpoint." 93 pp., $2.

Eno's "The Uses of Hydraulic Cement." 260 pp. Ohio Geological Survey.

Faija's "Portland Cement for Users." 110 pp., $1.20.

Falk's "Cements, Mortars and Concretes." 176 pp., $2.50.

Gatehouse's "Handbook For Cement Works Chemists." 141 pp., $1.75.

Gibson. See Webb.

Gilbreth's "Concrete System." 184 pp., $5.

Gillette and Hill's "Concrete Construction Methods and Costs." 690 pp., $5.

Gillette's "Handbook of Cost Data for Contractors and Engineers." 1841 pp., $5.

Gillmore's "Practical Treatise on Limes, Hydraulic Cements and Mortars." 334 pp., $4.

Godfrey's "Concrete," reprint of articles more or less controversial. 448 pp., $2.50.

Grant's "Strength of Cement." $4.25.

Grimsley's "Clays, Limestones, and Cements. $2.25.

Hagloch's "Art Stone," superficial. 126 pp., $1.50.

Hanson's "Cement Pipe and Tile." 110 pp., $1.

Hawkesworth's "Graphical Handbook for Reinforced Concrete Design." 70 pp., $2.50.

Heath's "Manual of Lime and Cement" in construction. 215 pp., $2.50.

Heidenreich's "Engineers' Pocket Book of Reinforced Concrete." 364 pp., $3.

Heidenreich's "Monier Constructions." 40 pp., 50 cents.

Hill. See Buel; also Gillette.

Hodgson's "Concretes, Cements, Mortars, Plasters and Stuccos, How to Make and How to Use Them." 520 pp., $1.50.

Hodgson's "Plaster and Plastering, Mortars and Cements." $1.

Houghton's "Concrete From Sand Molds." 145 pp., $2.

Houghton's "Ornamental Concrete Without Molds." 128 pp., $2.

Houghton's series of 12 handbooks for concrete users, each describing a separate special use, such as wall forms, floors and sidewalks, silos, chimneys and roof tiles, etc. 50 cents each.

Howe's "Symmetrical Masonry Arches." 170 pp., $2.50.

Howe's "Treatise on Arches." 369 pp., $4.

Jackman's "Crushed Stone and Its Uses, Facts of Importance in Connection with Modern Concrete Construction." 119 pp., $1.

Jameson's "Portland Cement," out of print. 192 pp., $1.50.

Kahn System Standards. $1.50.

Lathbury and Spackman's "American Engineering Practice in the Construction of Rotary Portland Cement Plants," a trade publication. 215 pp., $2.

Lesley's "Concrete Factories." 152 pp., $1.

Lewerenz. See Bellinger.

Lewis's "Waterproofing, An Engineering Problem." 53 pp., 50 cents.

Marsh and Dunn's "Manual of Reinforced Concrete and Concrete Block Construction." 290 pp., $2.50.

Marsh and Dunn's "Reinforced Concrete." English. 660 pp., $7.

Marsh's "Concise Treatise on Reinforced Concrete." 233 pp., $2.50.

Maurer. See Turneaure.

McCullough's "Reinforced Concrete," a manual of practice. 128 pp., $1.50.

Meade's "Portland Cement, Its Composition, Raw Materials, Manufacture, Testing and Analysis." 385 pp., $3.50.

Mensch's "Architects' and Engineers' Handbook of Reinforced Concrete Construction," a trade publication. 217 pp., $2.50.

Mensch's "Reinforced Concrete Pocket Book." 224 pp., $10.

Michaelis's "Hardening Process of Hydraulic Cements." 29 pp., 50 cents.

Moersch's "Concrete Steel Construction," Der Eisenbetonbau translated by E. P. Goodrich.

Mueller's "Manufacture of Portland Cement in the United States." 54 pp., $2.

Newberry's "The Constitution of Hydraulic Cements." 24 pp., 50 cents.

Newberry's "Hollow Cement Block Building Construction." 25 pp., 50 cents.

Newberry's "How to Use Portland Cement," from the German of L. Golinelli. 29 pp., 50 cents.

Newman's "Notes on Concrete." $2.50.

Palliser's "Modern Cement Sidewalk Construction." 90 pp., 50 cents.

Palliser's "Practical Concrete Block Making." 90 pp., 50 cents.

Patton's "Practical Treatise on Foundations." $5.

Potter's "Concrete, its Uses in Building From Foundations to Finish," English small building practice. 328 pp., $3.

Radford's "Cement Houses and How to Build Them," superficial. 157 pp., 50 cents.

Redgrave and Spackman's "Calcareous Cements." 310 pp., $4.50.

Reid's "Concrete and Reinforced Concrete Construction." 884 pp., $5.

Reuterdahl's "Theory and Practice of Reinforced Concrete Arches." 126 pp., $2.

Rice's "Concrete Block Manufacture, Processes and Machines." 152 pp., $2.

Rice, Torrance, et al. "The Manufacture of Concrete Blocks and Their Use in Building Construction." 122 pp., $1.50.

Richey's "Building Foreman's Pocketbook and Ready Reference." 1118 pp., $5.

Richey's "The Building Mechanics' Ready Reference, Cement Workers' and Plasterers' Edition." 458 pp., $1.50.

Richey's "Handbook for Superintendents of Construction, Architects, Builders and Building Inspectors." 742 pp., $4.

Riegler's "Failures in Concrete Sidewalks and How to Correct Them, with Specifications." 17 pp., 25 cents.

Ring's "Reinforced Concrete in Theory and Practice." 200 pp., $2.50.

Sabin's "Cement and Concrete." 572 pp., $5.

Sidewalks, Cement. 37 pp., 25 cents.

Spackmann. See Redgrave; also Lathbury.

Spalding's "Hydraulic Cement." 300 pp., $2.

Specifications for Cement, Standard Methods of Testing and, of the American Society for Testing Materials. Edgar Marburg, secretary. 32 pp.

Sutcliffe's "Concrete, It's Nature and Uses." 396 pp., $3.50.

Sutcliffe's "Notes on the Testing and Use of Hydraulic Cement." 376 pp., $1.

Taylor and Thompson's "Treatise on Concrete, Plain and Reinforced." 585 pp., $5.

Taylor's "Practical Cement Testing." 320 pp., $3.

Testing. See Specifications.

Thompson's "Reinforced Concrete in Factory Construction. 249 pp., 50 cents.

Thompson. See Taylor.

Tile, Cement. 50 pp., 25 cents.

Torrance. See Rice.

Trautwine's "Concrete, Plain and Reinforced." 200 pp., $2.

Turneaure and Maurer's "Principles of Reinforced Concrete Construction." 317 pp., $3.

Twelvetrees's "Concrete Steel," English. 230 pp., $1.90.

Twelvetrees's "Concrete Steel Buildings." 408 pp., $3.25.

Tyrrell's "Concrete Bridges and Structures." 128 pp., $2.50.

Warren's Handbook on Reinforced Concrete." 268 pp., $2.50.

Waterbury's "Cement Laboratory Manual." 122 pp., $1.

Watson's "General Specifications for Concrete Bridges." 82 pp., $1.

Watson's "General Specifications for Concrete Work as Applied to Building Construction." 46 pp., 50 cents.

Watson's "Standard Plans for Highway Bridges of Reinforced Concrete."

Webb and Gibson's "Reinforced Concrete," brief and general. 150 pp., $1.

Webb's "Masonry and Reinforced Concrete." $3.

Wilkes's "How to Manufacture Concrete Hollow Blocks." 16 pp., 50 cents.

Wittekind's "Hollow Concrete Block Houses." 65 plates, $1.

Books on Accounting for Contractors.

Have you book on accounting for contractor of public works, or can you refer me to any one who has?

T. A. Y.,
Manitowoc, Wis.

Garrison's "Accounting Every Business Man Should Know," ($1.32) is a good book on the general subject. The other books in print are mainly devoted to the methods of cost keeping, such as Gillette and Dana's "Cost Keeping and Management Engineering" ($3.50); Hall's "Manufacturing Cost" ($3); Arnold's "Complete Cost Keeper" ($5) for factories, etc. Special attention is called to the series of articles by DeWitt V. Moore upon "Contracting Practice," which began in the May number of MUNICIPAL ENGINEERING. They are giving some of the information which is probably desired and discuss the principles upon which methods of accounting for public works contractors in particular must be based. This is the most valuable contribution to this discussion which has yet appeared.

Manipulation in Analyzing Bituminous Paving Mixtures.

In determining the percentage of bitumen in any surface mixture, a large percentage of dust remained in the pores of the filter paper. Would you kindly explain through your query column the standard method for determining this? I have read Richardson on the subject, but his explanation does not appear to be sufficiently specific.

B. J. H., Stockton, Cal.

The chemists versed in bituminous materials who have read this question state that the simplest process in the filtration method is to use filter paper leaving no ash and burn it after drying, the residue being the mineral matter referred to. Mr. Richardson removes that which can be brushed off easily so as to leave as little as possible in the filter paper.

Will our readers state the details of their methods of manipulation for the benefit of our correspondent as well as others?

Inspectors' Notes on Sewer Work.

Less than a year ago I saw I believe in your magazine a system for an inspector's notes on sewer work. I have looked but cannot find it. Can you advise me in what number it was?

S. W. H., South Norwalk, Conn.

Probably the article in vol. xxxix, p. 471, is the one asked for. This article does not give a system for keeping inspector's reports but it gives references to a number of earlier articles on the subject, of which there are several in vol. xxxviii and earlier volumes. A form of record of city improvements in vol. xl, p. 222, may aid in the study.

How to Prevent Silting Up of Drainage Ditches.

I am interested in methods used to prevent the silting up of open drainage ditches with broken gradient, which resolves itself into the problem of maintaining a uniform velocity throughout the ditch. These breaks of grade most frequently occur at the outlet of lateral ditches into the main drain, lateral ditches sometimes entering a main drain several feet above the bottom of it. I have never found a satisfactory solution of the difficulty myself, or at least one that I was satisfied with and would like to learn of methods used that have given satisfactory results. It is often impracticable or not of economic benefit to construct ditches with a uniform gradient owing to the topography of the country and the problem of preventing the silting up of the ditch with a broken grade line becomes an important one. Any information that you can give me of methods that have proven successful will be appreciated.

B., ———, Mo.

The problem would not be difficult should conditions remain the same, for each stream, natural or artificial, ultimately takes care of itself and equalizes its flow in volume and velocity and the engineer needs only to guide this natural tendency into lines which will interfere as little as possible with the effects he wishes to produce. But the conditions are quite different when the ditch is running full from those when it is at low water, and so constant vigilance is necessary to prevent breaks in grade are necessary. A sudden damage to the drainage system, in case the break in grade produces an acute condition which is difficult if not impossible to control. A gradual reduction in grade distributes the difficulty over a larger distance and so the trouble is not so insistent at any one place and will not require so constant attention, but when attention is demanded the amount of work to be done will be increased much in the same proportion that the time between cleanings is increased. However, it is possible, sometimes, so to concentrate the flood flow on these sections where trouble is expected that it will do at least part of the moving of the previously made deposits. The branch ditches sometimes prevent the best treatment on the line, but if they are as high as the question suggests, they may be made to add their help by proper design of the junctions of side ditches with main ditch. It is quite possible, by curves, changes in cross section, lengthening of grades near outlets, tangential admission of flow of side ditch into main ditch, etc., to reduce the velocity of current in the side ditch at the entry into the main ditch at least to that in the side ditch proper at a distance from the outlet, and so cut out the acute difficulty directly at the junction. Occasionally it may be necessary to make the difficulty as acute as possible and establish a permanent plant for cleaning the ditch at such point, which can then be worked at a maximum of economy.

Each drainage engineer and constructor has his own practical methods of treating this problem and MUNICIPAL ENGINEERING invites its readers to contribute to the pleasure and profit of this correspondent and many other readers by sending descriptions of special devices used and the success attained and statements of principles which they consider established by the facts they have observed.

Water Supplies by Compressed Air.

Kindly let me know if you have anything in air pressure water system. I am installing one now and there is talk of them not giving satisfactory work.

H. K., Emmetsburg, Ia.

The writer knows of no plant which is entirely successful and all of them are, necessarily, small. The only available source of information seems to be the manufacturers of the plants. Will our readers give us some information based on their own experience or refer us to persons who will give it?

How to Measure Water Supply Furnished City.

I am in need of information as to how I can accurately measure the flow of water furnished by our pumping station for city use. Our conditions are as follows:

The water is pumped from the river to the reservoir a distance of 4,000 feet through a 12 or 16-inch pipe. The elevation of the reservoir is approximately 150 feet above the water in the river. The water is then transmitted by gravity to the city through a 16-inch pipe with a fall of 50 feet or more.

What I desire to know, can a weir be placed along this line, or at any point, that will obtain correct results. If so, where can I get the information as to how to construct such weir.

If there is any other method by which we can obtain the above results I would certainly feel under obligations to you if you will advise me of the same.

If you know of any cities that are working under similar conditions that are using some method of measuring the water pumped I would be glad if you will advise me of same.

M. B., ———, Kan.

The simplest measurement can be made over a weir if the connections of the inlet or outlet pipes are such that a weir can be inserted at inlet or outlet. The standard weir is described in all modern books on hydraulics, and the methods of construction, of making observations and of computing results are fully stated. The weir will have the most uniform flow over it if it is placed at the outlet of the reservoir, and the determinations of the flow will therefore be the most accurate. The data given in the question are not sufficient to warrant any suggestions as to methods of constructing the outlet chamber so as to make all the water pass over the weir on its way to the outlet pipe.

A Venturi meter placed in the main supply pipe will give a permanent means of keeping a record of the variations in the flow of water to or from the reservoir, according to whether it is located on the inlet or the outlet pipe.

Some of our readers may be willing to describe any temporary or permanent installations which they have made for the purposes mentioned, whether of weirs, meters or other devices.

Water Rates in Small Cities.

If you have published the cities and villages having water works, specifying which is municipal and which is private, in the states of Indiana, Ohio and Kentucky, of populations under 10,000, it would be of particular interest to me as I am interested in a rate revision in a plant in this state and the average rate in this case cannot exceed, according to the franchise, the average rates of cities of the fifth class in Indiana, cities of the fourth class in Kentucky and villages in Ohio. Kindly advise anything that you have published relative to rates and ownership of properties that would be of any assistance and apply to my case.

R., ———, Ind.

According to the latest available list, the cities and villages in the states named having populations between about 3,000 and 10,000 are the following:

Indiana: Municipal plants: Alexandria, Attica, Auburn, Bedford, Bloomington, Bluffton, Brazil, Columbus, Connersville, Decatur, Dunkirk, Fairmount, Garrett, Gas City, Goshen, Greenfield, Hartford City, Huntington, Kendallville, Lebanon, Madison, Martinsville, Mishawaka, Montpelier, Newcastle, Peru, Plymouth, Portland, Rochester, Rushville, Sullivan, Tipton.

Private plants: Aurora, Crawfordsville, Frankfort, Franklin, Greencastle, Greensburg, LaPorte, Lawrenceburg, Linton, Mt. Vernon, Noblesville, Princeton, Seymour, Shelbyville, Valparaiso, Wabash, Warsaw, Winchester.

Kentucky: Municipal plants: Bowling Green, Cynthiana, Danville, Lebanon, Ludlow.

Private plants: Ashland, Bellevue, Dayton, Earlington, Frankfort, Georgetown, Hopkinsville, Madisonville, Mayfield, Maysville, Middlesboro, Mt. Sterling, Paris, Richmond, Shelbyville, Somerset, Winchester.

Ohio: Municipal plants: Alliance, Ashland, Athens, Barberton, Bellaire, Bellefontaine, Bellevue, Bridgeport, Bryan, Cambridge, Canal Dover, Collinwood, Coshocton, Crestline, Cuyahoga Falls, Delphos, Eaton, Elyria, Fostoria, Fremont, Gallipolis, Greenfield, Greenville, Hillsboro, Kenton, Lakewood, Lancaster, Lisbon, Logan, Madisonville, Martins Ferry, Middletown, Mt. Vernon, Napoleon, Nelsonville, Niles, Norwalk, Norwood, Oberlin, Painesville, Ravenna, Reading, St. Bernard, St. Mary, Sidney, Toronto, Troy, Van Wert, Wapakoneta, Wellston, Wellsville, Wooster.

Private plants: Bowling Green, Bucyrus, Circleville, Conneaut, Defiance, Delaware, Dennison, Galion, Jackson, Kent, London, Marysville, New Philadelphia, North Baltimore, Pomeroy, Salem, Shelby, Uhrichsville, Upper Sandusky, Urbana, Warren, Washington C. H., Xenia.

Following are some of the rates for metered water reduced to the common price of cents per 1,000 gallons. While very few of the cities and villages in the list are using meter rates to any large extent, and only one or two exclusively, the two columns for municipal and private plants may be compared with interest. The column of maximum rates gives the price of interest to the ordinary citizen. The column of minimum rates gives the rate offered to large consumers, ordinarily for manufacturing purposes, and often indicates, especially in municipal plants, the concessions which the city is willing to make to such large users for their benefit to the city generally.

INDIANA METER RATES.

Municipal.	Max.	Min.
Huntington	25	10
New Castle	10	8
Peru	20	15
Portland	25	7
Private.	**Max.**	**Min.**
Greencastle	40	15
Greensburg	35	15
Mt. Vernon	50	20
Noblesville	160	60
Seymour	40	sp.
Wabash	40	20

KENTUCKY METER RATES.

Municipal.	Max.	Min.
Bowling Green	25	13
Danville	50	sp.
Ludlow	25	14
Private.	**Max.**	**Min.**
Frankfort	15	sp.
Hopkinsville	30	10
Paris	25	16
Shelbyville	30	10
Winchester	25	16

OHIO METER RATES.

Municipal.	Max.	Min.
Ashland	20	8
Athens	30	8
Bellefontaine	15	3
Canal Dover	20	6
Coshocton	20	6
Eaton	20	13
Elyria	15	8
Fostoria	20	sp.

Greenville	8	8
Hillsboro	30	10
Logan	30	8
Madisonville	40	8
Martins Ferry	30	10
Mt. Vernon	20	15
Napoleon	15	10
Niles	40	10
Norwood	40	8
Oberlin	30	20
Painesville	30	13
Ravenna	15	5
Reading	30	8
Van Wert	30	7
Private.	Max.	Min.
Bucyrus	25	sp.
Circleville	30	15
Defiance	40	sp.
Delaware	25	sp.
Dennison	35	15
Galion	25	sp.
Kent	15	9
London	25	16
Marysville	25	sp.
Salem	30	8
Shelby	25	sp.
Warren	35	10

The flat rates are not so readily compared, as they vary so much in items and combinations of items. Some attempt at a comparison is made in the following table. The family rate is computed for a family of five or a house of 7 or 8 rooms, with the usual fixtures for which extra charges are not made, and does not include such extra charge fixtures as water closet, bath tub, wash bowl, horse and carriage and hose. The family rate is reduced as nearly to a comparable figure as is possible under the variations in charges. The rates for the extra charge fixtures are taken directly from the rate cards. All the rates are in dollars per year. The rate for hose or lawn sprinkling varies much in basis for charge and is assumed for a lot 50x150 feet in size and made to apply to this standard lot as nearly as the statement of the rate will permit.

INDIANA FLAT RATES.

City	Family	Water Closet	Bath	Bowl	Horse	Hose
Municipal Plants.						
Alexandria	4.00	1.50	2.00	0.50	1.00	6.00
Connersville	3.00	1.50	2.00	1.50	2.00	3.00
Huntington	6.00	2.00	2.00	0	1.00	.....
New Castle	.....	1.50	2.00	0.50	1.50	.....
Peru	6.50	2.00	2.00	0	2.00	4.00
Plymouth	3.00	2.00	2.00	....	1.00	3.50
Portland	4.00	3.00	4.00	2.00	3.50	4.00
Private Plants.						
Greencastle	7.50	5.00	5.00	4.00	3.00	5.00
Greensburg	8.25	3.00	3.50	1.00	3.00	7.50
Mt. Vernon	8.00	3.00	4.00	....	2.00	.....
Noblesville	6.50	5.00	5.00	0	3.00	5.00
Seymour	7.25	3.50	3.00	....	10.00	8.00
Wabash	8.00	3.00	4.00	....	2.00	5.00

KENTUCKY FLAT RATES.

Municipal Plants.						
Bowling Green	12.00	3.00	3.00	2.00	.....	8.00
Danville	8.00	4.00	4.00	0	7.50	8.00
Private Plants.						
Frankfort	7.00	3.00	2.50	1.00	4.25	.....
Hopkinsville	6.00	5.00	6.00	5.00	4.50	5.00
Paris	6.00	4.00	4.00	2.00	5.00	6.00
Shelbyville	7.00	4.00	4.00	2.00	5.00	5.00
Somerset	8.00	6.00	5.00	3.00	.....	.....
Winchester	8.00	4.00	4.00	....	5.00	6.00

OHIO FLAT RATES.

Municipal Plants.						
Ashland	4.50	3.00	3.00	3.00	3.00	5.00
Athens	5.00	3.00	3.00	0	3.00	5.00
Bellaire	8.00	2.00	3.25	....	.....	.....
Bellefontaine	4.00	2.00	2.00	0	3.00	.....
Bryan	4.00	3.00	2.00	....	2.00	.....
Canal Dover	7.00	2.00	3.00	0.50	2.00	2.00
Coshocton	7.00	2.00	3.00	0.50	2.00	3.00
Eaton	5.00	2.50	2.50	0.50	3.00	met.
Elyria	8.00	3.00	3.00	....	1.50	5.00
Fremont	6.00	2.00	3.00	0	2.00	0
Greenville	4.00	2.00	3.00	....	1.50	5.00
Hillsboro	5.50	2.50	2.50	....	2.50	.....
Logan	4.00	2.00	3.00	0	2.00	8.00
Madisonville	6.00	2.50	2.00	1.00	2.50	3.00
Martins Ferry	9.00	3.33	3.33	1.00	.....	7.50
Mt. Vernon	6.50	2.00	2.00	0	2.00	4.00
Napoleon	4.00	2.50	4.00	0	2.00	5.00
Niles	8.00	3.00	3.50	....	3.00	.....
Norwood	5.50	2.50	2.00	1.00	3.00	3.00
Oberlin	5.00	3.00	3.00	....	3.00	7.50
Painesville	8.00	4.00	4.00	4.00	5.00	Sp.
Ravenna	5.00	2.00	2.00	0	2.00	2.00
Reading	5.50	2.50	2.00	2.00	1.50	.....
Toronto	7.00	3.00	4.00	....	3.50	.....
Troy	5.00	2.00	2.50	2.00	3.00	.....
Van Wert	5.00	3.00	3.00	....	2.50	5.00
Wapakoneta	5.00	2.00	2.00	0	1.00	3.00
Private Plants.						
Bucyrus	7.00	3.00	3.00	0.50	2.00	5.00
Circleville	7.50	2.00	....	....	2.50	.....
Defiance	8.00	3.00	5.00	1.00	2.50	5.00
Delaware	7.00	3.00	3.00	....	3.00	37.00
Dennison	6.50	5.00	3.50	1.00	3.00	5.00
Galion	8.00	4.00	4.00	1.50	3.00	6.00
Kent	6.25	2.50	2.50	1.50	.....	.....
London	6.75	3.00	3.00	....	2.50	5.50
Marysville	6.00	3.00	3.00	....	3.00	5.00
Salem	5.00	1.00	3.00	1.00	2.25	5.00
Shelby	8.00	4.00	4.00	1.00	3.00	.....
Xenia	6.75	3.00	3.00	....	2.50	5.50

These data are taken from the last edition of the "Manual of American Water Works" ($3) and a few changes may have been made since the date of report, but in the main the rates given are correct.

It is evident that no definite result can be obtained from a consideration of these figures. When one considers the differences in the actual cost of furnishing water under the greatly varying conditions in the places named, it becomes evident that the rates cannot be uniform.

When a small city or village is desirous of securing a water works plant and cannot raise the money to build the plant itself, it may be very desirable to pay a company a rather large price for taking the risk and the trouble of putting in a plant and building up a business. So far as immediate concessions are concerned, the municipal authorities and the company can make their bargains with full knowledge on both sides, but if the contract ties the municipality up for a long period of years or in perpetuity and makes it impossible to modify its provisions as conditions change, then the municipality is paying too dearly for its improvement. The first schedule of rates may very well be tentative and subject to change up or down, as may be found necessary, at the end of five or ten-year periods, that they may be kept as nearly equitable to both sides as is possible. The water company being in every sense but one a public corporation, and doing a public service, it is only just to require such publicity or official knowledge of the business and accounts of the company as shall make it possible to fix the rates so that they shall produce a liberal return upon the money invested, but no more.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Concrete Base for Steam Railroad Track.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Referring to request of "City Engineer" and of yourself for information regarding concrete foundation for steam railroad track carrying heavy traffic, in a recent number.

The Union track lying in Division street, Evansville, Ind., connecting the E. & T. H. R. R. and L. & N. R. R., lies along the center line of a brick street, carries heavy freight and passenger trains, being the transfer track between the above railroads over which all of their common Chicago-Florida and Chicago-New Orleans trains pass; and is supported by a concrete foundation underneath the ties.

This track had cost at least $350.00 per year for maintenance (a little over one-half mile long) and was then in poor condition practically all of the time, owing to bad subgrade and leaky water pipes lying just beneath the surface.

There is much heavy hauling along this street and it was, at times, almost impossible to cross from the brick paving on one side of the track to the other with a loaded wagon. Citizens remonstrated, newspapers printed news items and even gave the condition of the track editorial mention.

In 1908 an attempt was made to put the track in good condition by planking it solid at a considerable expense. This made the raising of joints a very difficult matter and was otherwise unsatisfactory.

In 1909 an experiment was made with a concrete foundation under two blocks as shown on attached plan. (Lower one in figure.) Twelve inches of concrete, 9 ft. 6 in. wide, was placed under the track and a 6-inch curb run up to top of ties, so as to make it monolithic with the base. A 5-inch layer of broken stone and screenings was placed under the ties and the spaces between the ties and between the rails was filled with broken stone and screenings. Crossing plank made a continuous driveway from the outside of the rails to the brick paving of the street.

During the winter of 1909-1910 a 10-inch snowfall in Evansville blocked the through trains until the snow had all been shoveled off the plank-covered portion of Union track and the planking, which was heaved by the frost, had been taken up.

This planking was later replaced, but many of the boards were bad and the condition of the track as bad as ever.

The experimental two blocks stood this snow and frost so well that it was decided to improve the remainder at the earliest possible opportunity.

Dull business and a change in management delayed the matter until autumn of 1910. In spite of the lateness of the season work was begun on November 8, 1910.

An attempt was made to hold the track up on switch ties laid beneath the ties and parallel to the rails while excavation was going on. This method was used for the two blocks between Main street and Heidelbach avenue, but it proved too inconvenient and expensive. West of Main street car line crossing the track was thrown onto the brick paving along the north side of the street and ballasted up there. Nearly all of the industry sidings were put out of service. The Ninth and Reid street car line was not in service and as there was already a concrete foundation under the crossing, the track was cut on both sides of the crossing frog and connected up alongside. This left the old road bed clear for work and dirt was thrown upon and material unloaded from cars of the work trains, which were kept alongside all the time, excepting while passenger trains used the tracks. Freight trains, whenever possible, were detoured via Belt Railway, so as to give work trains more time.

When the excavation was completed the concrete gang followed up with two mixing boards and placed 12 inches deep by 9 feet wide of concrete mixed 1 part cement to 6 parts of a rather poor mixture of sand and gravel pumped from the railroad company's pit at Emison, Ind. Concrete was carried out under switch ties of turnouts to heel of frog only.

The mixing and placing of the concrete foundation was the only part of the work, except setting of curbing, that was done by contract, all other labor was regular section and extra gang labor.

The mixing ((all by hand) was done very rapidly and not always thoroughly, but always wet. Thin ice often formed on the water covering the concrete in the mornings.

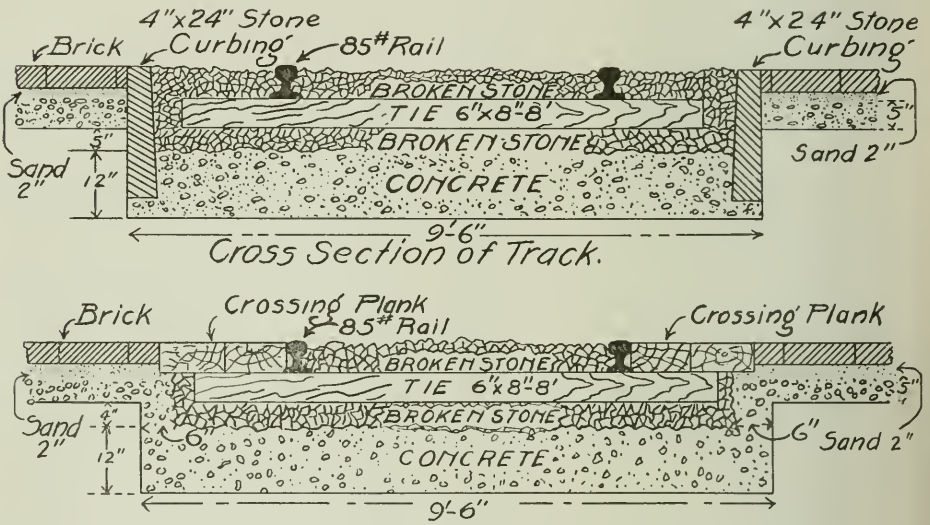
In spite of this it made a very fair concrete. Few faults have been discovered though no expansion joints were put in and it showed up a very good concrete where pieces had to be removed to make room for stone curbing.

About a week after concrete had been placed, new ties were laid, new 85-lb. rail spiked to these and the track partly ballasted. The old track was 70-lb. rail and that was taken into stock as relay rail. Very few of the old ties were in condition to use again.

The new track laid, the setting of the curbing was begun. The curbing was set upon the brick pavement on one side of the street, and by detouring all except the fastest freight trains have already been mentioned. The city authorities required one side of the street kept open for vehicles, so it was not possible to store materials on the street.

The track was put into service when concrete had set 21 days.

The entire length of the track underlaid with concrete in 1910 was 2570 feet, at a total cost for labor and materials (not including new ties and new heavier rail), of $9,000.00.



UPPER SECTION FINALLY ADOPTED.
LOWER SECTION UNSATISFACTORY ON TRIAL.

flush with the top of the pavement and 4 feet 6 inches from center line of track to near side of stone. At first 18 and 20-inch Kentucky limestone was used for curb. This was later changed to 20 and 24-inch. (No reason is given for using more than one width and 20 and 24-inch pieces were jointed together). It was all 4 inches thick, tamped up on limestone screenings 4 to 6 inches deep and the brick paving back of it together with the concrete foundation under the brick replaced and a neat cement grout poured over and swept between the bricks.

Owing to the advanced season, there was much difficulty in getting the quarries to furnish stone for curbing and ballast. The quarrymen could not work when it rained or snowed and would not work when there was frost. It took a goodly number of bright days and much exchange of correspondence, long distance conversation and telegrams to get the work completed by March 1st.

The difficulties in excavation, keeping track open for passenger trains and for work trains by means of a temporary track thrown

Labor was plentiful at 15 cents per hour. Foremen were paid $60.00 per month.

DETAILED COST.

Grading, 1,500 cu. yds. at .60		$900.00
Concrete Base, cost per cu. yd.		
Labor	$1.26	
Water	.11¼	
Cement	1.40	
Gravel and sand	.30	
	$3.07¼	
About 900 cu. yds. at $3.07¼		2,765.00
(Contractor was allowed 21 sq. yds. extra for concreting to heel of frog of each turnout from main track.)		
Stone Curbing,		
2,570 lin. ft. of 18 and 20-in. at 32 cents	$ 822.00	
2,570 lin. ft. of 24-in. at 39 cents	1,002.00	
Freight average 5 cents per ft.	257.00	
Curb setters at 4 cents per ft.	206.00	
Curb setters help at 2 cents per ft.	103.00	
5,140 lin. ft. cost		2,390.00

Ballast, 1,150 cu. yds. 1-inch and under white and blue limestone at $1.12 ..... 1,289.00

Labor, Ballasting and constructing new track and throwing, ballasting and taking up old track at 50 cents per ft. 1,285.00

Labor, Replacing concrete foundation under brick, replacing brick and grouting 371.00

Total $9,000.00

Railroad and city officials and citizens generally are well pleased with the condition of the track and it is thought that the improvement is permanent.

J. G. BERGER, C. E.
Mt. Vernon, nd.

Best Pavement for Steep Grade.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The question department of MUNICIPAL ENGINEERING for March, 1911, contains the following:

What, in your opinion, is the best material for a street improvement from a safety point of view, with a grade of 10 per cent? What is your opinion of bituminous macadam pavement for a grade of this kind? Do you think it would have a tendency to wash?

HARVEY STREET, PAWTUCKET, R. I.
Bitulithic Pavement on 12 per cent. Grade. Macadam Street in Foreground.

Perhaps one of the best ways to answer this question is in the light of experience and I therefore submit the following:

Harvey street and Park Place, in this city, were the first streets upon which a bitulithic pavement was ever laid. This pavement was put down in June, 1901, and today, ten years later, both streets are in very good condition.

On Harvey street the grades are as follows: 227 ft. of 4.9 per cent, 180 ft. of 7.4 per cent, 160 ft. of 12 per cent.

On Park Place the grade is comparatively flat and is only referred to in this connection because it was one of the first pavements of this kind to be laid.

The pavement on Harvey street has always afforded a good foothold for horses and has never washed.

I enclose two photographs of this street which are of interest as showing its present condition. They were both taken in January, 1911, and for the purpose of showing the

HARVEY STREET, PAWTUCKET, R. I.
Bitulithic Pavement on 4.9 per cent. Grade.

difference between a macadam surface and a bituminous macadam surface after a heavy winter rain.

This is partially illustrated in photograph No. 1, by the rutty, muddy character of the ordinary macadam street at the foot of Harvey street, and in photograph No. 3, on Broadway, where a short section of bitulithic pavement is shown, just in front of the two horses, and where the remainder of the street is macadam covered with a pasty mud. This short piece of bitulithic was placed in Broadway at the intersection of two falling grades, to facilitate the draining of the street to the catch basins.

In photographs No. 1 and No. 2 can be seen the mosaic character of this pavement, as shown by the surface of the stones which catch the high-lights.

Photograph No. 1 is of a 12.0 per cent

BROADWAY, PAWTUCKET R. I.
Macadam Street with Short Section of Bitulithic.

grade and photograph No. 2 of a 4.9 per cent grade. Harvey street has never had repairs made upon it.

GEO. A. CARPENTER, City Engineer.
Pawtucket, R. I.

Competition in Public Contracts.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I have read with special interest the editorial in your July issue regarding and liberally extracting from Major Gilette's paper on the above subject prepared for the American Society Engineering Contractors, and also the full paper published by the Society, and am pleased to respond to your request that your readers add to the discussion.

I quite agree with Maj. Gillette and others in discussion of the paper that the American Society of Engineering Contractors is the organization which should take the initiative in practical correction of the evil.

I cannot entirely agree with Maj. Gillette's prescription for a cure. I believe more can be accomplished by placing even greater responsibilities upon public officials, holding them to a strict accountability for their proper exercise, and then providing adequate means for the detection, exposure and correction of any abuse of the powers which may be entrusted to them. It is, in my judgment, a serious mistake to attempt to make men honest by the passage of laws which on their face assume that all men are dishonest. I believe our laws at present are generally based too little on the fixing of individual responsibility and too much on suspicion of general dishonesty of public officials and an effort to force honesty by legal safeguards—a result which I believe can never be accomplished. If more responsibility, confidence and discretion were placed in our public officers, we would find more high class citizens ready and glad to take public office for the honor it carries and the good they can accomplish.

The first fundamental error, as it seems to me, in the article, is the effort to eliminate by legal enactments the element of personal liability and responsibility of both the public official and the private contractor.

The second is the failure to recognize the necessity of having two distinct kinds of competition—that between different things answering the same general purpose and that between bidders for the same thing.

The third is an entire misapprehension of what is meant by and what can be accomplished through competitive bidding, and the failure to realize that in the last analysis there can be competitive bidding only as to the percentage of profit for which one contractor is willing to undertake the work as compared with another, unless it be that the public is willing to take its chances in securing the work to be properly done where it is known that the contractor takes the contract for less than cost.

Every contract is made up of three items—labor, materials and profit. Assuming the cost price of the first two to be approximately the same, there is only room for competition as to the profit to be made.

The above suggestions naturally raise the question as to whether we have not reached the point where the principle of doing business on the competitive basis is not out of date and where we must look for the correction of abuses to publicity and the general elevation of the moral tone of business, and a higher order of integrity and efficiency in all public servants, coupled with the elimination of the political "Boss" in its generally accepted, and rather uncomplimentary, sense and recognize that every organization, political or otherwise, must have a leader who may in the case of public service be honest and work to the public good.

Let us proceed on the theory that all men are born honest and that most men would prefer to remain so and generally will remain so if encouraged to give the best that is in them and if given a remuneration for service which is consistent with their effort and responsibility and which will enable them and their families to live as people in their stations should live and, in addition, save a reasonable amount. This applies with equal force to contractors as well as public officials. How many engineers and other executive officials in our small or even large communities who are expected to devote their entire time to the work are paid salaries which are so small as to be entirely inconsistent with the positions they hold, the results they are expected to accomplish and the expenses of living in a way such men should live to be a credit to themselves and the public? How frequently does it occur that the public is pleased when there is evidence that a contractor has taken a contract at a low price—one which cannot yield a profit and will surely yield a loss if honestly administered?

Is not the whole system of competitive bidding and award of contracts to the lowest bidder (regardless of responsibility, including previous experience in the line of work undertaken, evidence of honesty of purpose or otherwise and of the profit or loss on the work) based on the wrong principle of grinding the contractor down to a basis on which he cannot live and carry out his contract honestly ruinously excessive competition in other words?

Do not such conditions as to both officials and contractors breed and encourage, if not almost force dishonesty on the part of both?

In any reform we undertake let us assume that officials (engineers or otherwise) as well as contractors are honest and place in the officials the responsibility and the confidence which that assumption would carry with it. Then pay the officials fair salaries and you will generally get good service, although at times in public as well as private life there will be an occasional wrong-doer.

Let the contractors understand that their bids will be as readily rejected if too low as if too high and that experience, responsibility and general reliability in the past will weigh as heavily in determining the award as the amount of the bid in dollars and cents. Would any of us if we were to build an expensive house hire an architect

who would work at the cheapest rate and then advertise for bids and say to the contractors—"The man who offers to do the work for the least money and gives a surety company bond will get the work?" What kind of a house would we get on that plan? In such cases do we not consider price as only one of the many important factors for consideration in awarding the contract? Who has ever heard of satisfactory result through surety bond after the contractor has failed because the contract price is too low?

THE SPECIFICATIONS.

As Maj. Gillette forcibly states, the specifications should be clear and distinct and as brief as practicable. They should avoid all trick clauses and at the end of every paragraph should state under what item of the contract and bid the work embraced in that paragraph is to be paid for. "Discretion of the engineer" should be eliminated and yet some things must be left to the "best judgment" which is another way of stating "discretion" of the engineer, but its exercise should always be fair. Too often the engineer considers his duty is to get all he can for his employer, however unfair to the contractor. In such cases it is only to be expected that the contractor will do his best to "recoup" and the engineer who is so narrow as to take unfair advantage of the contractor is generally sufficiently dense so that the contractor can find a way to "put one over" on him.

THE UNBALANCED BID.

As Maj. Gillette says, this is the most potent means of exercising dishonesty. It is only made possible through unbalanced quantities of the engineer's estimate, whether the error in estimate is due to dishonest design, to incompetence, or to undue haste or lack of care in making the estimate. Even contractors with an honest purpose are pretty apt to avail themselves of an opportunity to "unbalance" their bids if the estimate offers the opportunity, knowing that even if they do not "unbalance" some one or more of their competitors are pretty certain to see the opportunity and avail themselves of it.

Let contracts provide that if any item of a contract exceeds 20 per cent of the estimated quantity the excess shall be done at cost of labor and materials plus fifteen per cent regardless of the contract price for such item, and let the engineer understand that when any item exceeds the estimated quantity by more than 20 per cent the fact will be regarded as prima facie evidence of incompetence and be followed by rigid investigation and probable discharge, if the investigation proves the error to be due to either incompetence or dishonesty. Then, at least intentional unbalancing of bids and estimates will be promptly stopped and engineers will exercise more care than they often do at present.

In some cases the quantities cannot be accurately estimated in advance and in such cases the "cost plus fifteen per cent" basis of payment for the excess will check dishonesty. Never put in a contract a clause that if certain unanticipated contingencies arise the work "will be done by the contractor without extra allowance." Nothing could be more unfair, for instance, than a clause in specifications for a pavement that if "soft or springy places develop in the sub-grade they shall be dug out by the contractor and refilled with sound material (earth, stone, cinders or concrete) as the engineer may direct without extra charge." Yet this is a common clause in pavement specifications, and equally unreasonable and similar clauses are found in specifications for other classes of work.

If the contractor, in the construction, is faced with such a condition, he is sure to know he has been "robbed," and if he doesn't retaliate by "stealing" some cement out of the concrete or otherwise it will be because he doesn't know how—not because he is dishonest, for he will be pretty certain to figure out in his own mind that, under the circumstances, such retaliation is honest. In every construction unforeseen contingencies are liable to occur. It is absolutely dishonest to throw the extra expense on the contractor and specifications should always provide for such cases, that such unanticipated or unforeseen work shall be paid for at "cost of labor and material plus fifteen per cent" or, as is the custom of the city of Toronto and some other cities, include in the specifications and contracts a long list of unit prices generally accepted as fair and reasonable which will be the measure of pay in case such unanticipated work is required. The cost and percentage basis is the more fair for both parties because a schedule of unit prices cannot be made which will be fair to all cases regardless of quantity or other conditions of the unforeseen work.

RELATION OF ESTIMATE TO CONTRACT.

Maj. Gillette suggests that no bid should be accepted if the price of any item exceeds the engineer's estimate by more than 10 per cent. Such a system would too much encourage engineers to make unfairly low estimated prices or to force the using of an incompetently prepared estimate as the final basis of contract. I have known cases where such a system was in vogue and on which, from my knowledge of costs, I believe the engineers systematically estimated about 5 per cent below actual cost in order to entice the unwary contractor and get low bids. In such cases you may be sure the contractor will "work his wits" to get even and I believe, generally speaking, will succeed in accomplishing the end at the expense of more or less poor work and still consider himself honest. So long as contracts are based on such lack of confidence and fairness between the contractor and engineer, so long will there be dishonesty in carrying out of contracts. Employ only competent engineers; pay them fair salaries; treat the contractors fairly, yea, honestly, and I believe 90 per cent of

the rascality in public work will be removed.

It is often customary to estimate a nominal quantity and receive unit prices for classes of work of which some may he required but the engineer cannot tell where, or definitely, if any nor how much will be required. For instance the estimate may have an item "10 cubic yards concrete" and the bids for that item are sure to be high. Is it not far better to state that if any concrete is required it will be paid for at "the actual cost of labor and materials plus 15 per cent?"

A case recently came to my attention in a country road contract which contained the general provision that the price of no item shall exceed 10 per cent of the engineer's estimate. "Grubbing and clearing" was described as usual and paid for at a lump sum. Either through dishonesty, lack of study of the situation or incompetence the engineer did not estimate there would be any grubbing and clearing," but provided an estimate of "grubbing and clearing lump sum $1.50." The contractor could bid 10 per cent. advance or $1.65. He "guessed" that the engineer knew there would be no grubbing and clearing and with only three days' time to read the specifications, travel 200 miles to look over the site and get back with his bid and bond and with no stakes showing exact location of the work, he could not check the item. In full confidence of the accuracy of the engineer's estimate he did not avail himself even of the 15 cents excess the contract permitted him to bid but bid the exact amount of the estimate—$1.50. If he had bid $1.66 his bid would have been illegal, informal and rejected. When he came to do the work he encountered a great many trees and stumps, some quite large, and his "grubbing and clearing" cost him $700. The contracting board was "sorry" but could not "go back" of the contract and the contractor was "milked."

I may have a wrong conception of the word "honesty" but in my judgment it was just as dishonest for that engineer to make the estimate as he did as it would have been for the contractor to have used four parts of sand to one of cement when the specifications call for three to one in the concrete. When the engineer doesn't know where the material is to be used it is unfair and dishonest to provide either a unit or lump sum price in the bid to cover such unanticipated construction.

PATENTED ARTICLES.

When any patented article is embraced in any construction or the use of any patented machinery is required the engineer should require the owner of the patent to file with the contracting board an agreement to furnish the patented article or machinery to any responsible contractor at certain definite terms and such agreement of the patentee should be embodied or at least referred to in the specifications.

If it be suggested that the owner of the patent has it within his power under such a proceeding to favor one contractor by offering to furnish his patented material or machinery at a less price than that stated in the agreement filed with the contracting board, this could only be done by the owner of the patent depriving himself of the royalty which he would otherwise receive, and is no more than the owner of any manufactured product or material, such as brick, asphalt, wood or granite blocks, could do by offering to furnish the material called for by the specifications to one contractor at less price than that furnished to another, while the inducement to favor one contractor at the expense of another is less necessary in the case of the owner of a patent than it is with the manufacturer or owner of other materials required to be used in the construction.

EMERGENCY WORK.

Maj. Gillette proposes to absolutely tie work in excess of $100 to formal contract made after ecareful preparation of specifications and advertisement to run sufficiently long time for contractor to become familiar with the work and the contracting board to canvass bids, etc.

Suppose a break occurs in the Erie Canal. It might cost $5,000 to repair immediately but if left for contract the damages and cost of repair might exceed ten times that and we come back to the statement with which I opened that we must consider that our officials are honest and give them such discretion as the honest conduct of their offices demand to the best good of the public service. I believe that with a good deal more confidence in public officials, the public would be far better served.

SUGGESTED LAWS.

Commenting on Maj. Gillette's suggestion for amendments to laws governing public contracts, I think it is a great mistake to have the State Legislatures pass laws which limit or regulate public service in matters on which the local officials are or should be more conversant and the administration of which necessarily depends on local conditions to a greater or less extent. In my humble judgment we already have too much rather than too little general law regarding public contracts and that the hands and reasonable discretion of our public officials are already tied too much.

The duty and responsibility of local self government should not be attempted to be taken away from municipalities by general acts of the Legislature, which cannot possibly be familiar with the local conditions about which it undertakes to legislate.

Referring more particularly by corresponding numbers to the clauses of Maj. Gillette's proposed law, I would comment as follows:

1. As noted above the absolute requirements that all work in excess of $100 shall be done by public contract is impracticable, at least in case of emergency. If "emergen-

cies" are excepted from the law it opens the legal question of whether or not any particular case is an "emergency." In my observation and experience, as a rule, cities are best and most competently, and apparently most honestly governed when the officials are given wide discretion to do work either:

a. By public letting after advertising for bids which they will generally adopt.

b. By private contract after negotiation without advertising for bids.

c. By direct purchase of labor, materials and equipment.

2. Engineers' estimates of cost should, as Maj. Gillette suggests, be "filed in the office of the public official who invites the bids" and I would add "and included in the notice to contractor and specifications and available to the public and bidders."

3. The suggestion to advertise sufficiently before the letting and in enough papers to give due notice to contractors is good.

4. Definiteness of specifications and contracts is well put by Maj. Gillette. I see nothing in this clause, including its subdivisions "a" to "k," which does not seem to me to be good.

Regarding paragraph 1 (at the bottom of page 21 of the Society proceedings). As indicated above, I think the contracting board should not be tied to any percentage of the engineer's estimate, either in total or in particular items. I believe the public will be better served if the public officials are assumed to be competent and honest and the responsibility placed on them as such.

5. The letting of contracts should not be limited to "citizens of" and "corporations doing business in" the state. If so limited why not go farther and limit to residents of the city or ward. Every responsible contractor experienced in the work to be undertaken should be free to bid everywhere.

6. I heartily agree with Maj. Gillette's recommendation regarding the public opening of bids and rejecting of bids having erasures.

7. Bids should be opened on time or rejected unopened. As above stated, I don't believe in the inviolable rule of acceptance of the "lowest bid" and believe the public service can be most efficiently administered by permitting discretionary latitude to public officials, always holding them legally responsible for an abuse of the discretion, and requiring them in awarding a contract to another than the lowest bidder, to state publicly their reasons for awarding the contract to the bidder selected.

8. I do not agree with Maj. Gillette's suggestion that there is now any necessity for broadening the right of legal procedure to inquire into the legality of contracts, as the courts are now and always have been open to any general taxpayer to contest the validity of any contract awarded by a public official, and instead of broadening in any way the legal right to inquire into the validity of contracts, I would suggest restricting the right of any property owner or taxpayer to allow the use of his name for the purpose of contesting the validity of the legal proceedings where it can be shown that the suit has been brought in good faith, and that the property owner has been indemnified against all legal liability for the use of his name by some rival or disgruntled contractor who for spite or other selfish reason seeks to tie up the prompt execution of public work, and that all such suits should be promptly dismissed by the court where these facts are proven.

9. The clause fixing responsibility of inspection is good.

The basic error of Maj. Gillette's paper is the assumption that all public officials are dishonest and that laws can be framed to prevent dishonest officials from robbing the public. Laws cannot make men honest—they can only punish their misdeeds when detected, throw restrictions around the opportunities for fraud, and afford the public an opportunity to be relieved from their effect when detected. Laws have never yet and never will make men honest or elevate the moral tone of business or secure freedom from "graft" where dishonest public officials owe their selection or appointment to the political "Boss," who, under existing laws, is able to "deliver the goods." Instead of attempting to enact laws which assume upon their face that both public officials and contractors are dishonest, thereby suggesting to them a means of avoiding the effect of the laws, while apparently complying with their provisions, I suggest that we proceed upon directly the opposite assumption, and merely undertake to provide by laws for the prompt publication of every purchase made by any public official, giving the nature of the purchase; the name of the party supplying the article; and the price, quality and quantity purchased, where practicable; the general nature of every contract to be let; and when let the name of the contractor and price paid, and also to provide in the same publication for a monthly statement of the cash receipts and disbursements made by all public officials, and for the public criticism in the same publication of all acts of public officials, where such criticism is made over the signature of the party making the same. Public sentiment is at last the tribunal before which the conduct of all public officials must be tried.

In conclusion, I believe the province of this association is in an effort to mold popular opinion and official action rather than in enlisting in the passage of more or less complicated laws which should be a matter of local consideration and responsibility of local officials and taxpayers, and to finally treat the matter from the point of view that both contractors and officials are to be trusted and considered honest but watched, publicly exposed and promptly discharged or prosecuted if found "wanting" in the proper exercise of the trust committed to their keeping.

GEORGE C. WARREN,[1]
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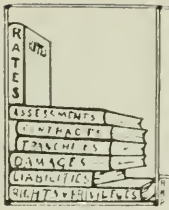


MUNICIPAL MATTERS IN COURT

Higher Courts—City Cannot Sell Water Outside.

Decisions of the Higher Courts of Interest to Municipalities.

Limitations of Assessments for Public Improvements.—An act provides that the assessment for local improvement shall be paid in annual installments not to exceed 25 per cent. of the assessed benefits in any one year, and that no single improvement shall be undertaken which alone shall exceed in cost 20 per cent. of the value of the real property in the district as shown by the last county assessment. *Held,* that where a street improvement required an expenditure of more than 20 per cent. of the value of the property in the improvement district as shown by the last county assessment, but by reason of contributions from the county and city, much less than such 20 per cent. limit would have to be assessed on the property, the improvement was authorized.—McDonnell et al. v. Improvement Dist. No. 145 et al. 133 S. W. 1126.

City May Locate Manholes in Sidewalk.—A city may have sewer catch-basins located in the sidewalks, unless the plan adpted is inherently dangerous; and the fact that the surface of the basins was of smooth iron, so as to be more slippery than if made of wood or corrugated iron, was not negligence, so as to make the city liable for injuries to one slipping thereon.—McCourt v. City of Covington (Ky.), 136 S. W. 9101.

Municipality Is Not Dissolved by Reason of Military Occupation or Territorial Cession.—A municipal corporation is not totally dissolved as a mere consequence of military occupation or territorial cession. The present city of Manila, reincorporated by the Philippine Commission with substantially the same municipal powers, area, and inhabitants as the Spanish municipality of the same name, is liable upon municipal obligations incurred prior to the cession of the Philippine Islands by the treaty of Paris of December 10, 1898, to the United States. A debt incurred for coal to be used in a municipal waterworks system is a municipal obligation, although the municipality holds property and funds in trust to be devoted to the establishment and maintenance of said system.

A Water Company's Charter Constitutes a Contract.—A water company's charter constitutes a contract between the company and the city served which the city cannot alter without the company's consent. Where rates charged by a water company can be changed only by agreement between the company and the city, the company will be restrained from charging an increased rate agreed to by the city on condition that no meter rental charge be made, where the company refuses to abide such condition.

Substitution in Specifications by Authority of an Official May Not Be Made After Contract Is Let.—Suit by a city on the bond of sewer contractors to recover the expense of repairing broken tile was sufficiently covered by instructions that use of fine earth, instead of sand, in laying pipe, would not entitle the city to recover unless the defective condition complained of was caused by such substitution, and that no city officer could authorize the substitution.—City of St. Louis v. Rueching et al. (Mo.), 134 S. W. 657.

City Not Liable for Loss Under a Rescinded Contract.—The damage suit of David McCormick against Henry M. Scales, former mayor, and the City of Oklahoma City, for $50,000 damages has been decided in the Federal Court of Oklahoma in favor of the defendant. McCormick is a paving contractor of St. Louis and was awarded paving contracts in this city amounting to more than $500,000. After the contract had been awarded, the council rescinded its action, whereupon McCormick entered suit against the mayor and the municipality. The amount sued for, $500,000, was the prospective profit on the contract.

City Liable for Work by Independent Contractor.—A city cannot escape liability for damage caused to abutting property through a defective plan of street construction, because the work was done by an independent contractor.—Potter et ux. v. City of Spokane et al. (Wash), 115 P. 176.

Right of a Property Owner to Surplus Earth from Street Improvements.—Where, in the case of a street improvement, an abutting owner is entitled to surplus earth removed from the street, and he desires to exercise the right to remove it for his own use, he must act promptly in asserting the right and, where he fails to remove the soil, he must be deemed to have abandoned his right thereto.—Sinker-Davis v. City of Indianapolis et al. (Ind.), 94 N. E. 886.

Municipality May Not Supply Water Outside of the City Limits.—A municipality,

owning and operating a waterworks plant, has no power to supply water to persons living outside the municipality; and such power does not result by necessary implication from the power of the municipality to supply water to its own citizens.—Steitenroth et al. v. City of Jackson (Miss.), 54 S. 955.

City May Employ Associate Counsel—Compensation.—A city may employ associate counsel to assist its city attorney in any case where its authorities deem it necessary. The bond given in an unsuccessful injunction suit against a city covers the reasonable amount necessary to compensate special counsel to assist the city attorney in defending the suit.—Vicksburg Waterworks Co. et al. v. Mayor and Aldermen of Vicksburg, (Miss.), 54 S. 852.

Right of a Water Company to Refuse Service on Account of Non Payment of Debt.—A contract by a public service water company to supply water to a consumer, which provides that it may shut off the water for non-payment for 15 days of water bills, and that it may require payment of all water rents and charges as a condition to again supplying water, refers to water rent and charges for supplying water under the contract, and the company may not, as a condition to restore water service, demand payment due for water supplied at a previous time and different place.—Benson v. Paris Mountain Water Co. (S. C.), 70 S. E. 897.

Right of Municipality to Condemn Property for Water Works.—The statute authorizing the city to pass ordinances for the protection of land used for water purposes outside of the city limits, it had power to condemn land for water works purposes located outside of its corporate limits. The compensation awarded for land condemned is determined by its market value, and in determining such value the adaptability of the land for a particular purpose may be considered, together with its probable demand for that purpose, especially if it be unusual, so as to affect the market value, but uses which are so speculative as not to affect the market value cannot be considered.—Edwards et al. v. City of Cheyenne et al. (Wyo.), 114 P. 677.

Consequential Damages for Condemned Land.—Commissioners and experts in valuing land condemned to widen a street could consider it as a whole, and were bound to give the full value of the land actually taken with any consequential damages resulting to the land remaining. In determining the consequential damages to remaining land resulting from condemning land to widen a street, the commissioners could consider that the street had been increased in width, thus increasing the easement of light and air, and the general desirability of the property along the street. In re Roebling street in City of New York (N. Y.), 127 N. Y. S. 944.

Contract to Supply Water Outside of City Limits May be Terminated at Will.—The council of defendant city granted complainants the privilege of connecting with the city water mains and the use of city water at their residences outside the city limits, provided the city ordinances were complied with, one of which authorized the supply of water to persons outside the city who should enter into a contract with the city containing a reservation by the city of the right to terminate the contract on 30 days' notice. Complainants without entering into any formal contract, made connections with the city mains at their own expense, and alleged that, in reliance upon representations by the city that they could obtain a water supply, a new house was built. *Held,* that the city was not estopped by any representation or by complainants' expenditures from terminating the agreement on 30 days' notice.—Childs et al. v. City of Columbia (S. C.), 70 S. E. 300.

City Has No Right to Enforce Public Service Rate Reduction.—In the absence of a delegation thereof by the Legislature, express or necessarily implied, a municipal corporation has no power to regulate or control rates for public service, such as the furnishing of water, gas, or electricity, or the terms and conditions of contracts therefor, otherwise than by contract with the corporation or person rendering such service.—Bluefield Waterworks & Improvement Co. et al. v. City of Bluefield et al. (W. Va.), 70 S. E. 772.

Right to Tap City Water Mains Is Not a Franchise.—The water purveyor of a city gave plaintiff the privilege of tapping the end of a city water main, and at its own expense to lay the pipe from the end of the main to its premises to supply itself with water. *Held,* that the permit so granted was not a franchise, as a franchise can only be granted by the legislative body of the city, and hence the levying of a special franchise assessment upon the line of pipe by plaintiff was unauthorized.—Peope ex rel. Peter Cooper's Glue Factory v. Board of Tax Commissioners (N. Y.), 127 N. Y. S. 992.

City Not Liable for Unforeseen Accidents Due to Natural Causes—Distinction Between Judicial and Administrative Functions of a City.—In an action against a municipality for damages to land caused by a slide of earth in opening a road where defendant had the services of a competent engineer, and, in running the cross-section lines to determine the amount of cut and fill, he examined the ground where the improvement was to be made, and prepared specifications thereon, and no slide had ever been known in that vicinity, and he was never informed of the existence of a fissure therein, his judgment respecting the plan was all that reasonably could have been required from an inspection of the conditions, and the city was not liable. A municipal corporation in devising plans for improving public highways within its borders acts judicially, and, when proceeding in good faith, is not liable for errors of judgment, but in constructing the work it acts ministerially, and must see that the plan is executed in a reasonably safe and

skillful manner.—Giaconi v. City of Astoria (Or.), 131 P. 855.

Use of Patented Material Does Not Limit Competition in Paving Awards.—The statutes relating to towns and cities, provides that a board of public works shall let a contract to the lowest and best bidder; section 8710 relates to the determination by voters or by the council of the kind of material to be used in a street improvement. A corporation having patent rights in a paving material called bitulithic proposed to grant to the city, or to any accepted bidder for paving work, the right to use it for a specified royalty, conceded to be reasonable, the city to have the use of such right for repair of pavements for which the contracts were let during 1908. The city accepted the proposition and after a petition under section 8710, requiring the use of bitulithic, prepared specifications calling for bitulithic paving, specifying that the rights conferred by the company were granted to any contractor at the same rate. *Held,* in an action by a taxpayer to enjoin the letting of the contract, that the use of the patent rights provided in the specification was not an interference with the competition contemplated by the statute.—Tousey v. City of Indianapolis et al. (Ind.), 94 N. E. 228.

City Not Responsible for Misinterpretation of Specifications.—Where contracts for the construction of sewers were based on carefully drawn plans and profiles, showing grades, etc., drawn to a scale with the horizontal and vertical scale plainly marked thereon, the contractors bidding were bound to determine the quantity of work required by the plans and specifications themselves, and were not entitled to rely on a mistake in interpretation thereof procured from the office of the city engineer.—Hanrahan et al. v. City of Janesville (Wis.), 130 N. W. 482.

A City May Not Sell Water Beyond Its Own Boundaries.

The city of Reading, Pa., owns and operates a water works system which comprises six sources of supply, six storage reservoirs, a distribution reservoir, a pumping station and supply or distribution lines.

Of the six sources of supply, five are gravity supplies; the sixth, the Maidencreek supply, being pumped into the reservoirs, etc., and furnishing all the water needed for consumption over and above that yielded by the other supplies.

The latter yields an average daily supply of about 6,087,000 gallons, while the consumption is about 12,276,000 gallons per day. The proportion pumped from Maidencreek is about one-half.

The quantity of water carried by Maidencreek is greatly in excess of the average daily consumption as well as the capacity of the storage and distribution reservoirs. In pumping water from Maidencreek and in collecting from gravity supplies more water than is needed for daily consumption is pumped and collected. There is, in other words, always a daily balance of water in the reservoirs over and above what is required to meet the daily consumption. But in order to utilize the whole of what the various sources of supply are capable of furnishing, the city would be obliged to increase its storage facilities and pumping.

The Glenside Water Company was incorproated for and is engaged in the business of selling and furnishing water to the inhabitants of Bern township, and the Reading Suburban Water Company was incorporated for and is engaged in the business of selling and furnishing water to the inhabitants of Muhlenberg township, both townships adjoining the limits of the city.

About the beginning of April, 1903, the Board of Water Commissioners of the city of Reading, without previous authority from the city councils, entered into contracts with the above named companies, to be in force for ten years and contemplating renewals for a further like period, permitting them to make attachments to the city's water mains and thereby obtain the supplies of water needed by them in their respective businesses, the companies to pay for these supplies at rates lower than those charged to residents of the city. The attachments were accordingly made within the city limits, and the companies used the water of the city and resold it to their consumers outside of the city.

The Reading Suburban Water Company, also by permission of the water board, took water from the Maidencreek supply main, belonging to the city, by connections therewith beyond its limits, and sold the same to certain of its customers outside of the same.

An injunction was sought to prevent the selling of water to persons outside of the city limits, but upon the rates being raised to conform with those paid by the residents of Reading, the injunction was withheld. Later suit in equity was entered and a decision was rendered in favor of the Reading consumers.

The conclusions in this decision were, briefly, as follows:

The city of Reading has no power to sell or sanction the sale of any part of its water for consumption beyond its boundaries.

The Board of Water Commissioners of the city of Reading had no power with or without the consent of city councils to enter into contracts they made with the Glenside Water Company and the Reading Suburban Water Company, or either of them.

The supplying of water by the city of Reading, or its Board of Water Commissioners, to the said companies is an unlawful misappropriation of the property of the city.

The plaintiff is entitled to a decree declaring said contracts illegal and void, and permanently enjoining defendants and all and every of them from performing said contracts, and from selling and supplying or receiving and reselling water of the city of Reading; said injunction, however, to become operative only on and after August 1, 1911.

ROADS AND PAVEMENTS

California Macadam—Chicago Boulevards—British Dust Problem—Allegheny County Highways—Georgia Roads—Dust Prevention Experiments.

Macadam Roads in California.

In commenting on the reason why macadam roads in California are not of the best Mark R. Daniels, C. E., calls particular attention to the defects in construction. These are given at some length in the San Francisco Bulletin and are briefly summarized as follows:

Primarily, the macadam road must withstand the pressure of a load concentrated at four points, namely, the points of contact of the wheels with the road surface. It is evident that no matter how dense and hard may be the road covering, if the soil beneath be soft, sooner or later the road will give way and a rut will be formed at these soft places.

For this reason the surface of the ground is cleared of all organic matter, soft places filled with good solid material and the surface rolled, tamped and treated until it becomes sufficiently hard and firm to withstand the traffic. This is called preparing the sub-grade. Since the character of the work here done is soon hidden by subsequent work, it is, like the political organization which gives it being, generally rotten.

But it is quite evident that while the sub-grade may be sufficiently firm to uphold the load, it will not, if composed of earth alone, withstand the wear of traffic. So a hard surface substance must be found to perform this service.

Broken stone immediately suggests itself. But broken stone will not serve the purpose unless held together and in place.

Experience has taught us that the best material is the finely crushed particles of stone, which, when wet, make a very good bonding material.

When such a road is built, each factor takes its place in the equation, as follows: The sub-grade supports the actual weight, although it will not do so unless properly prepared. The coarse, hard rock withstands the attrition of the wheels and tires, while the stone dust and screenings maintain the coarser rocks in their relative position, thus acting as a binder.

On the sub-grade thus prepared are spread the materials for macadamizing. This is the point where the errors in method are so apt to creep in.

The method most commonly used on this coast is as follows: First, a layer of clean, coarse rock of a size which will pass through a two-inch ring, is spread upon the prepared sub-grade, four to six or eight inches thick, depending upon the amount specified. Upon this layer of coarse rock is spread a course, two to four inches, of fine rock or screenings.

The entire road is then saturated with water, when it is rolled until it becomes hard and firm. Let us now investigate the condition that obtains under such a method of construction.

In all bodies of broken rock there is perhaps about 30 per cent. of voids. The object in distributing screenings over the surface of the first course or layer is to supply a finer material which will fill the interstices of the broken stone and act as a bond, as before explained.

But in order to do the work properly the finer material must fill all the voids.

With the present form of construction, however, the finer material is spread upon the top of the coarse rock and wetting and rolling is resorted to to drive this material into the interstices of a six to eight-inch layer of coarse rock. Such a thing is manifestly impossible.

It is true that a thorough saturating with water will tend to wash into these voids or interstices a larger percentage of fine material, but in no instance where I have made tests have I found all the voids filled.

The consequence is that the road presents a very smooth and even surface, which lasts just long enough to be accepted, when the loose support of the lower course begins to shift with heavy burdens, causing a rut, which, once started, like the rings created by the pebble in the pond, enlarges ever.

If the screenings, stone dust and all the finer materials were mixed throughout, or if the crusher run, as it is called, were used, a condition of no voids would obtain.

And yet we continue to construct roads in the manner dictated by the quarry men and contractors without stopping to analyze the problem or ascertain the cause of so many failures.

There are two reasons. One, that it is a cheaper form of construction; the other, that it saves materials. Both of which benefit the contractor.

It is often contended by contractors that the screenings on top will wash and roll in sufficiently to fill the voids that are not filled by the forcing of the earth up from the sub-

grade, but this is rarely true, and it is my opinion that no substantial macadam can be laid without using sufficient fine material well mixed with the broken stone to fill the voids.

Boulevard Improvements in Chicago.

The Chicago plans commission at a recent meeting adopted "Plan No. 3" for the improvement of Michigan boulevard, the Chicago river and Pine street.

"Plan No. 3" contemplates the widening of Michigan boulevard from Randolph street to the river, the construction of a new bridge at Pine street and the continuation of a double-decked boulevard and teaming street, connecting the north with the south side by way of Pine street, as far as Ohio, and a continuation of a widened boulevard as far north as Chicago avenue.

According to these plans Michigan avenue north of Randolph street to the river will be widened to 130 feet. Just south of the present approach to the Rush street bridge a teaming center will be created in the form of a plaza about 222 feet square. Branching off from this will be about five driveways, providing five routes to which teaming may be diverted. Just across the bridge, on the north side, will be another plaza of this sort, to serve a similar purpose. Over here the existing tracks of the Northwestern railroad will have to be met and encountered, but the present plans do not take them into consideration any further than they are taken into consideration by the surface traffic of the present day.

There is a slight change in the grade, but it is said by the engineers of the commission that these grades are made only with a tentative purpose, so that at some time in the future a change in grade may do away with these dangerous crossings.

The bridge included in the plan will have a breadth of ninety feet and will be of the general "jack-knife" plan—such as are in use at State, Dearborn, Clark and other streets.

In the widening of Michigan boulevard and Pine street the plan of the commission in "Plan No. 3" is to take sixty-four feet from the east side of the boulevard—giving it its present width to the southward all the way from Randolph street to the bridge.

Diverting from the present bridge at Rush street, the new plan provides for a divergence of the traffic by this "double-decked" route over a bridge connecting with Pine street—one block east of Rush and at present but little used by through traffic south of Ohio street.

On the north side of the river Pine street is to be extended to a general width of 141 feet by the condemnation of seventy-one feet on the west side of the street.

In general, the results of the new plan, when put into effect, would be a straight route across the river from the south to the north side and a general doing away with the present conflict between teaming and light vehicular traffic.

The Dust Problem in Great Britain.

The report of Consul-General John L. Griffiths, London, contains some interesting statistical matter relating to the dust problem in the United Kingdom. The Roads Improvement Association made the investigation and published the results. The information was obtained by circularizing the road authorities in different parts of the country.

In regard to the preparation of the road for treatment with tar, 56 surveyors pointed out the necessity of thoroughly cleansing the road from dust by sweeping it first with machine brooms and afterwards with hand brooms. Other replies, while more general, indicated that the road should be in good condition.

As to the kind of tar used and the price, 134 authorities used crude or ordinary gas tar; 25 used distilled or refined tar; and 6 used oil-gas tar. The prices varied from 2 cents to 8 cents per gallon, the usual price being between 4 and 5 cents. Twenty-nine authorities used specially prepared tarry materials, such as tarvia, tarmite, Clare's patent tar compo and dustabato.

In 33 cases the area treated per gallon of tar was between 3 and 5 square yards; in 99 cases it was between 5 and 7 yards; in 19 cases, between 7 and 9 yards; and in 5 cases more than 9 yards. When specially prepared tarry materials, oil-gas tar, or ordinary tar mixed with oil was used, the average spread to the gallon was greater than when crude or distilled tar was employed.

Asked as to what material was spread over after treatment, 77 authorities replied that they used sand; 37 used small (¼-inch) granite chippings and granite dust; 10 used large (over ¼-inch) granite chippings; 14 used limestone chippings or dust; 8 used slag chips or slag dust; 19 used road grit removed from the road before treatment; and 15 used local materials, such as shingle, pea gravel, cinder dust, etc. In 5 cases no material was placed on the road after treatment. Several surveyors express the opinion that granite chippings are the best material.

As to the method of spreading the tar and the cost, in 84 cases hand spreading was used, while machine spreading was practiced in 49 cases.

The average cost for treating the road surface, including all expenses of preliminary sweeping, tar, sand or other material spread after treatment and labor, varied between 1.4 cents and 6 cents per square yard. The usual cost was 2 to 2½ cents when machine spread and 2½ to 3 cents when hand spread. Where two coats had been given the cost of the second coat was much lower than the first.

In 61 cases the treatment lasted a season, 6 to 9 months; in 54 cases, 12 months; in 5

cases, over 12 months; and in 5 cases less than a season. In several cases when giving the road a second treatment it was necessary to treat only the center of the highway, the sides remaining in fairly good shape. In some districts the treatments lasted two years.

Modern Highway in Allegheny County, Pa.

Until very recently the country road was a dirt road, and even macadam paving was considered a luxury, except in the more populous centers. In New York, prior to fifteen years ago, there was scarcely a road of any description other than natural earth or gravel, outside of the villages and cities. Now, under the supervision of a well organized state road commission, the state is expending $5,000,000 per year in improved road construction. The amount of money expended in improved country highway construction during the past decade has probably equalled that spent for this purpose during the century preceding.

The macadam roads serve their purpose very well for the traffic of pleasure vehicles and farming wagons, but when the automobile began to be used to such an extent, a new condition presented itself, and roads which were destined to be serviceable for four or five years with but little attention began to go to pieces during their first year. Engineers everywhere sought a reliable and cheap preventive for the destructive action of the automobile tires, and innumerable experiments have been made, particularly by applying various bituminous compositions to the surface of the old roads. The results from these applications have met with exceedingly varying results.

With the application of the bituminous cement to the surface of the roadway, there is no certainty of the bituminous cement flowing or penetrating the interstices of the stone and the consequence is that some spots of the pavements have too much bitumen on the urface and practically none between the stones; and in other spots there will be no material to bind the surface particles together, and too much in the body of the surface. It can be readily seen that this method cannot be depended upon to accomplish the result desired, that is to thoroughly water-proof the surface and bind all of the particles of the stone together.

Realizing that the mixing method is the ultimate goal of the experimenters in improved country road construction, Warren Brothers Company, of Boston, Mass., have been experimenting for several years to devise some means by which the satisfactory results obtained with the bitulithic pavement might be applied to a less expensive construction, adapted to the lighter traffic of country roads, and as a result have evolved the "Warrenite Roadway."

The county commissioners of Allegheny county, Pennsylvania, after spending considerable time in investigation, selected the Warrenite roadway for a portion of the Steubenville pike. This pike is one of the main thoroughfares out of Pittsburg, Pa., and is subjected to considerable traffic for a country road. The problem of maintaining this road in a good serviceable condition was an expensive one for the county, on account of this traffic, and also the fact that the road was very narrow, being cut out of the mountain side for its entire length; and in addition to this the road had very heavy grades in places, which varied from 2 per cent. to 8 per cent. for its entire length. The original roadway was built of macadam on a telford base but had a crown of six inches in 14 feet of width, which would be very high for a level road, and was specially so for the hills which existed. The telford base had been in some years, and it was concluded to be a poor policy to disturb it, so in the construction of the Warrenite roadway the shoulders were built up and the depth at the center of the roadway was reduced. In this way the crown was reduced to three inches. The high crown of the original road resulted in confining the traffic to the center of the roadway, which wore down the original macadam pavement to the base in the crown, while the macadam on the shoulders remained practically intact.

In laying the new roadway, two inches of the Warrenite mixture was laid and rolled at the outer edges, and over this for the full width of the road was laid and rolled the two inches of wearing surface. After the surface had been rolled and hardened, the earth shoulders were built up and rolled to meet the new paving and to conform to its contour.

All the materials for the work came in by rail, about two miles from the work, and the mixing was done in a Warrenite mixing plant on the work and was hauled from the machine to the work in two-wheeled concrete carts. This contract was taken by the Standard Bitulithic Company, of New York City, operating under license from Warren Brothers Company. The work was done under the supervision of the county road engineer, Mr. S. D. Foster.

Good Roads in South Georgia.

Several hundred South Georgians, with accredited representatives from fourteen counties, met recently in Waycross, Ga., and organized the South Georgia Good Roads Association, with L. V. Williams of Waycross, president, and eight vice presidents. The association plans for a good roads train after the example of the agricultural college train, which has made two trips around Georgia. Another meeting was held June 29 at Statesboro. It is proposed to use automobiles to designate a number of highway routes through the state.

Experiments in Dust Prevention and Road Preservation.

The report of the U. S. Office of Public Roads on the observations made in 1910 of experiments in dust prevention and road preservative is printed in Circular No. 94 of the department. It includes some additional experimental roads at Ithaca, N. Y., and observations of those constructed in 1909; additional roads at Knoxville, Tenn., Ames, Iowa, Boise, Idaho, Washington, D. C., New York City, and Ridgewood, N. J.; and observations of the experiments at Youngstown, O., Newton, Mass., several places in Kansas, and Bowling Green, Ky.

Ornamental Lights in Hastings.

The first step for an ornamental lighting system for the business section of Hastings, Neb., has been taken by the council in the granting of a petition for ornamental lights in Lincoln avenue, between First and Fourth streets. The property owners have agreed to purchase iron posts for the lights and the city will supply the current to and maintain the lamps. A design for an ornamental standard will be accepted by the council, to be followed in all districts that may wish to adopt the system on the same basis. Each post will support either three or four Tungsten lamps. They will be placed at each corner on intersections and on both sides of the street at the middle of each block.

Investigation of Lansing's Street Illumination.

The committee from the Board of trade, composed of Saginaw business men, visited Lansing to investigate the street lighting and municipal plant at that city.

The committee's report to the board of trade shows that in addition to the 320 electroliers, or poles bearing one and three and five-lamp clusters of tungsten burners for lighting the business district, there are 200 incandescent lights and 303 arc lights.

The entire cost last year of all this lighting, which is a total of 823 separate lights and clusters, or a total of 1,503 lamps of all kinds, was $22,000. The full amount appropriated for street lighting was $25,000, but $3,000 of it was not used.

Saginaw has 391 arc lights in all for which the city pays. This is the grand total of the street lighting, the cost of which is defrayed by the city. The contract price for these 391 arc lights was $23,400 last year. Saginaw pays $60 per light, while at Lansing the cost is apportioned at the rate of $48 per light for arc lamps.

An official of the Lansing lighting and water department also informed Secretary Joseph P. Tracy, of the board of trade, that within a few years the municipal plant expected to be able to sell electricity to the people for lighting at 5 cents per kilowatt hour and make a profit.

Municipal Light in Pittsburg.

In the introduction of his annual report, Controller E. S. Morrow, of Pittsburg, asks for a thorough investigation of the light question with a view to installing a municipal plant large enough to light the entire city. The Controller has just completed an exhaustive investigation of the matter on his own account, and is ready to turn his figures over to the council with which to start its investigation. Director of Public Works Joseph G. Armstrong has also compiled a mass of information that will be available for the investigators, for he, too, believes the subject to be of vital importance to the city and one that should be taken up immediately.

According to the controller's report there are now in use in Pittsburg 4,000 arc lights, for which the city pays $70 a year each, and 1,000 more for which a charge of $90 each is made, the latter being in cases where current is furnished through conduits. Of course, the average cost from the conduit source of supply must include the additional cost of installing the conduits, which, according to Director Armstrong's figures, is very great.

The estimate for a single lamp on a plane of the magnitude of a plant for the size of this city is about $62 per lamp. His figures take into account depreciation, change of machinery and appliances, interest, taxes and every item entering into the total cost of production and maintenance. At this figure there is a possibility of the city saving $40,000 or $50,000 a year, and proportionately as the city grows.

The cost per lamp of operating the municipal plant in the former city of Allegheny is interesting in this connection and Director Armstrong has gone deeply into that phase of the matter. According to the annual reports of the Northside plant, the arcs maintained by the city cost $7 a year less than those contracted for with the light company.

Mr. Armstrong referred these figures to experts, who have declared that the head of the Allegheny plant has not charged himself with a number of items, including water, haulage, taxes on the property occupied and several other items. If these were added to the total cost, it is asserted that the cost of each lamp lighted from the little municipal plant would amount to $83.49, or almost $13.50 in excess of the contract light.

Mayor Magee is interested in the figures compiled by his works chief and those of the controller. He is known to favor the ownership of public utilities, but to have some decided views as to the advantages to be gained by the municipality operating them, believing that there are many obstructions to the city's ability to operate as cheaply as a private corporation. For instance, the city has to contend with the eight-hour law, the civil service, the fixed price of $2 a day for labor and other items that do not cut any considerable figure with a private corporation.

GARBAGE AND REFUSE

Montclair Garbage Disposal—Cleveland Garbage Plant—Bowling Green Sewage—Milwaukee Refuse Incinerator.

Garbage Disposal in Montclair, N. J.

Conditions at the Montclair garbage dump on the Garretson farm in Upper Montclair, which less than a year ago was condemned by the State Board of Health as being unsanitary and a menace to the health of the nearby residents, have been changed.

In fact, the Montclair officials to whom the change is due, Engineer Immediato and Garbage Inspector Edmondson, say that no other town in the State, if in the United States, has a system of the same nature. They say further than the only possible improvement over present conditions would be the establishment of a garbage incinerating plant, and even that, in some respects, would be less sanitary.

The two branches of a driveway to the thoroughfares meet about 200 feet from the dump, and it is from this point of intersection that the first view of the place is to be obtained. All that is seen is that the road ahead terminates on a huge stone platform, amply large for turning horse-drawn vehicles.

The farm land slopes to the eastward and the platform, although about on a level with the street, is raised high above the land at the lower end. The contents of the garbage carts are dumped into galvanized tanks.

The carts, which are of iron and covered with heavy oiled canvas, are, after the load is disposed of, driven to the lower side of the dump to a concrete washing platform, where they are thoroughly cleansed. The water from the washing is carried through a drain pipe to a cesspool through the open stonework sides of which it is dissipated into the earth far below the surface. The vehicles used in the collection are sent away from the place absolutely clean.

In Montclair kitchen refuse only is considered as garbage. Ashes, papers, etc., are disposed of in other ways, the ashes being used as filler for low ground and the papers and other dry refuse burned. Because the garbage is kept separate, it is in great demand by farmers as food for poultry and hogs. The agriculturists are willing to pay for the material and drive from long distances to obtain it. The farmers are allowed to have the stuff, but they also are compelled to observe the rules established.

Any one wishing garbage from the Montclair dump must have a tight wagon body, from which liquids will not drip, and a canvas with which to securely cover the load before driving off the ground. Before leaving the dump the farmers must wash the outside of their wagons.

To obtain his load of garbage the farmer drives onto the concrete washing platform at the lower side of the dump.

A trap in the tank is opened and the required material slides down into the wagon.

At the close of each day all material left in the tanks is drawn off into a cart and dumped into a nearby pit. It is then covered with quick lime and about two feet of soil. A hose is then turned into the tanks and they are thoroughly washed, as is also the platform.

The present system of garbage disposal was planned by Mr. Immediato several months ago. Before he could put it in operation, however, considerable work was involved. Trouble was encountered in securing water, as a part of the necessary piping from the street had to be laid over other land than that belonging to the owner of the farm where the dump is located. It was because of this difficulty in obtaining the necessary water supply that the new process was first put in operation only recently. It had been Mr. Immediato's intention to have the system in use before the summer months began.

Prior to the installation of the new system the process employed consisted in emptying the contents of the carts on the surface of the ground, whence it was shoveled into the farmers' wagons. The residue left at night was buried.

Although the greatest precaution was taken to allow no material to remain above ground at night, and quick lime was spread plentifully on the surface of the ground where the garbage had lain during the day, it was impossible to keep the flies away from the place.

To Exhibit Cleveland's Garbage Plant.

A miniature reproduction of the garbage disposal plant and pictures of the group plan probably will comprise the Cleveland exhibit at the International Municipal Congress in Chicago, September 18 to 30. Secretary Munson Havens, of the Chamber of Commerce, was instructed to prepare the display. It was impossible to give city funds for a Cleveland display, so the Chamber of Commerce took it up.

The Milwaukee Refuse Incinerator.

Since the opening of the new refuse incinerator at Milwaukee, Wis., there have been many more or less conflicting reports as to the success of the plant and the economy of its operation. The city department of public works was desirous of ascertaining the facts in the case and has been keeping records for the purpose of making comparisons. The Milwaukee Bureau of Economy and Efficiency has just published the results of a rather extended investigation of the plant and of the methods of operating it, made by the staff of that organization, assisted by the superintendent of the incinerator.

The first difficulty mentioned in the report was in the division of responsibility, the collection of garbage being under the board of health and the collection of ashes and refuse under the department of public works, prior to 1911. The bureau made its first recommendation that the collection be concentrated under the latter board, and during the present year this has been done. Changes in the schedules resulted in economies in garbage collection amounting to $5,130 to May 15 and probably to $8,550 for the year, the amount of garbage being about the same.

Another saving has been made by making the proportion of garbage conform to that for which the furnace was designed. Instead of 50 per cent. garbage and 50 per cent. refuse, the amount of refuse brought to the plant has been reduced until the percentage of garbage in the mixture incinerated has been increased to about 57, a saving of 1,417 tons of such refuse from January 21 to May 15, which is estimated to reduce the cost of destruction some $4,298 for the year. The refuse from the 7th ward is now taken to dumps instead of carrying it to the furnace, the cost of collection and delivery being practically the same in either case and the furnace being thus relieved of the extra refuse with the saving noted.

The differences in proportions of refuse from those for which the plant was designed have made necessary some changes in method of operation, which have increased the number of men employed and consequently the cost of operation. Some changes in form of wagon boxes so as to make dumping easier will also reduce the number of men necessary. Some of these changes have already been made and when the others are made the annual saving in the labor account will be about $5,836.

The plant was designed to utilize the steam and the clinker produced, but no use of them has been made as yet. Tests made by the city engineer and the superintendent of the plant show that, in addition to the power required to run the plant, a minimum of 640 kilowatts of electrical energy is available for commercial purposes, for which a net profit of $36,576 per annum is estimated. The cost of plant for utilizing the steam is estimated at $60,000.

It is estimated that the clinker, by the installation of a crusher at a cost of $2,800, can be prepared for use for foundation concrete and the like at a profit of $7,020 a year.

The dust from the combustion chamber can be sold at $3 a ton at the asphalt plant, it is claimed, and, allowing for delivery, a profit of $1,147 a year on the estimated production of 459 tons is computed.

Of these recommendations some have already been adopted amounting in all to $16,267 a year credit to the plant. Other early reductions in labor force will increase this by $3,964 and when the installations for utilizing steam and clinker are made a further credit of $43,596 can be earned. These all amount to $63,827 a year.

A careful study of the labor cost of incineration is made, based on three months of actual operation under existing conditions. This varies from $1.75 to $1.96 per ton. A "standard" cost per ton is estimated on the basis of the best conditions of operation under the standard existing circumstances, as the "goal toward which effort is to be directed." It is $1.2822 per ton of garbage, of which $0.9152 is direct furnace labor and $0.3670 is indirect labor, including superintendence. This "standard" cost is compared with the cost of $0.7215 per ton of garbage reported at the official test. The difference between the two is accounted for, first by the 36.7 cents indirect labor, above given, and second, by the greater cost of direct labor, arising for the reasons above given and from higher wages. This amounts to 19.37 cents. It is understood that the unnecessary labor of the actual operation is eliminated, according to the recommendations of the report, in producing the "standard" of cost.

The corresponding figures for total labor cost per ton of total refuse incinerated are 39.1 cents for the official test and 76.92 cents for the "standard" of future operation.

The report also shows the computation of other than operating costs for the "standard," viz:

Plant expense	1.72 cents
Maintenance	11.10 cents
Insurance	2.15 cents
Interest, rental, taxes	30.31 cents
Depreciation	30.33 cents

which, with the labor costs given above make the total cost of operating the plant, under the "standard" conditions, $2.1683 per ton of garbage incinerated. The corresponding cost per ton of total refuse consumed is $1.301.

The report contains a text-book of instructions for operating the plant, apparently prepared by Mr. S. A. Greeley, the superintendent, and a full set of forms for daily reports of collections and operation of plant, time sheet, and weekly and monthly statements of operation, finances and products of plant.

The recommendations of the investigating engineers, Prof. L. E. Reber and E. B. Norris, are largely those outlined above. They include one that so long as the products of the furnace are not utilized the col-

lections of garbage and refuse brought to the plant should be such as to consume the garbage at a minimum total cost of operation of the plant. The principal recommendation, however, is that the utilization of the steam and the clinker should begin as soon as possible. When it does begin the plant should be operated with the highest efficiency as a steam and clinker producer in view, second only to the sanitary disposal of the garbage.

Sewage Disposal in Bowling Green.

State Sanitary Engineer Paul Hansen, of Kentucky, has recently completed a survey for the proposed sewer system of Bowling Green. This report gives a detailed presentation of the nature of the problem in Bowling Green, together with recommendations regarding the proposed solution. A brief abstract of the report is given as follows:

The city of Bowling Green has a population of between 9,000 and 11,000. It lies on Big Barren river at the head of navigation. The river, which is a tributary of the Green river, is not much used for traffic, and the city depends almost entirely for transportation facilities upon the L. & N. railroad.

Bowling Green occupies a natural amphitheater formed by a crescent-shaped ridge in the southeastern portion of the city. The slope of the site upon which the city is built is in a general way toward Big Barren river to the northward, but the greater portion of the drainage from the city (and this includes the main business district) is intercepted by a small stream passing through the center of the city.

In former years much sewage entered the ditch, causing it to be exceedingly foul and offensive, but at the present time sewage has been almost entirely eliminated, and such as does enter is subjected to a more or less prolonged period of retention in cess pools or tanks. The result of this treatment is to render the sewage free from the coarser suspended matters, and for this reason its presence in the waters of the stream is scarcely perceptible to the eye. The most objectionable contamination, so far as appearance and odor are concerned, consists of a large volume of soapy liquids from a laundry and wastes from a gas house. Aside from this the stream is exceptionally free from the gross contamination that is ordinarily found in streams which pass through unsewered towns the size of Bowling Green.

The explanation of this lies in the peculiar character of the geological formation, which permits of the disposal of sewage and drainage through subterranean passages. The underlying rock, which in most parts of the city reaches to within a very few feet of the surface, is a very pure limestone which is readily soluble in water containing carbonic acid. The result has been the formation of innumerable channels within the rock varying from very small size to passage ways that may properly be called caverns. These channels are entered from the surface by natural sink holes or through holes drilled or excavated for the purpose. Practically all of the buildings in Bowling Green which have indoor plumbing have connection with one of these sink holes for disposing of sewage. If by this means the sewage could be effectively removed so that it would not appear elsewhere to contaminate wells or emerge at the surface and create offensive odors, the final disposal of the sewage might be considered satisfactory. This naturally endangers the wells throughout the city, so that for a number of years no wells have been used.

The proposed system, as outlined by Mr. Hansen, is substantially as follows:

That portion of the sewerage system contemplated for present installation comprises as its principal feature the main trunk sewer which is at once the most costly and the most important feature of the entire system. It is proposed to divert all of the storm water from the Big Sink, causing it to follow a natural drainage course leading to Big Barren river, about one-half mile distant, and to reserve the Big Sink for receiving sanitary sewage only. This will be accomplished by enclosing the sink with a cancrete structure so designed as to shut off all extraneous drainage. In addition there will be built a screen chamber, in which the coarser suspended solids will be removed from the sewage in order to prevent, as far as possible, a tendency to clogging in the irregular passages to which the sink hole heads. It may be mentioned that sedimentation was also contemplated as a means for removing the suspended solids from the sewage, but it was concluded to be unnecessary at present.

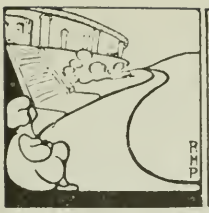
A diameter of 24 inches was adopted for the main outfall sewer as being necessary to meet all reasonable future demands. With the grades obtainable it should adequately carry off the sewage from a population of 25,000 persons. With 25,000 persons contributing to the sewers the total population of the community will be about 30 per cent. greater, or 32,000.

As the system of sewers branches out in various directions the main trunk sewer becomes progressively smaller, and under the plan proposed for immediate construction the main trunk will have a diameter of 12 inches at its upper end.

The cost of the proposed system, including all pipe, engineering, inspection, etc., is estimated at $35,879.

Calgary's Municipal Railway.

Calgary's (Alberta, Canada,) municipal street railway continues to make bi gearnings for the city. In May the system turned over eleven thousand dollars into the city treasury, besides adding more than four thousand dollars to the sinking fund and interest accounts.



ORGANIZATIONS & INDIVIDUALS

American Association for Highway Improvement — Smoke Prevention Association — International Municipal Congress — Calendar of Technical Meetings — Technical Meetings — Instruction in Highway Engineering — Technical Schools — Personal Notes.

American Association for Highway Improvement.

The first convention of the American Association for Highway Improvement will be held in Richmond, Va., September 12 to 15, 1911.

There have been so many first conventions of national highway associations under one name or another in the past four or five years that this announcement might pass unheeded unless particular attention were called to it. Unfortunately most of the conventions held have been national only in name and have been largely promoted for the benefit of special interests or individuals, so that one begins to be suspicious of any convention held in the interests of good roads, unless it is local enough so that the promoters of it are well known and their standing unimpeachable. This condition of affairs is one which has led those interested in the subject from the point of view of the roads rather than of the business interests concerned with their promotion and construction, to form an association on a basis and with a management which shall be truly national, which is well known, and which has no entangling alliances.

With this object in view the American Association for Highway Improvement was formed last winter with Logan Waller Page, the head of the activities of the United States in the promotion of the construction of good roads, as president, and J. E. Pennybacker, formerly one of his trusted assistants, as secretary. This association has already grown to large size and has secured funds enough to put good organizers in the field, to develop the work of the association and to bring about one of the most important objects of the organization, a close cooperation of all the legitimate organizations in the field, national, district, state, and local.

The success of the association is remarkable and insures a most valuable and interesting convention at Richmond in September. The program will be published in the September number of MUNICIPAL ENGINEERING, and meawhile information will be supplied by Secretary Pennybacker on request if he is addressed at Washington, D. C. Those interested in the cause of good roads should make their preparations to attend this convention.

International Association for the Prevention of Smoke.

The sixth annual convention of the International Association for the Prevention of Smoke was held at Newark, N. J., June 28-30. The four sessions were held in the City Hall.

The first session included an address of welcome by Mayor Haussling, of Newark; the transaction of routine business, and the verbal reports of the improvements effected during the previous year.

The Wednesday afternoon session was opened with an illustrated lecture on "The Relation of the Gas Producer to the Smoke Problem," by Prof. R. H. Fernald, consulting engineer in the U. S. Bureau of Mines. The lecture explained in a general way the operation of some of the types of gas producers. The gas producer was advocated as a means of utilizing low quality fuels with a minimum of smoke nuisance. Prof. Fernald referred to a few plants which had been in continuous operation without shut-down for several years as being truly smokeless. He stated that there were now 474 producer plants in the United States, of which 415 were operated on anthracite coal. These, however, were all small plants. Bituminous coal was used in all plants of large horsepower. In conclusion Prof. Fernald spoke emphatically in favor of central station plants and railway electrification as palliatives of the smoke evil.

The next paper on the "Enforcement of the Smoke Prevention Ordinance in New York City," by Dr. Ernest J. Lederle, commissioner of public health, of New York. This paper described the system of inspection, warnings and preferment of charges and gave statistics of the number of arrests and convictions and the amount of the taxes imposed during the past year.

A paper on "Smoke Prevention in Large Power Stations" was presented by Mr. James T. Whittlesey and Mr. Hervey S. Vassar, chief engineer and assistant chief engineer, respectively, of the Public Service Corporation of New Jersey. Mr. Vassar read the first

part of the paper, in which were outlined the difficulties of smoke prevention in the Public Service Corporation's power plants. Attention was directed to the liability of sudden and unexpected variations in the amount of steam required, which variations put a demand upon the plant which it was almost impossible to meet without smoke. Mr. Vassar advocated improved methods of management in the boiler room as the best plan for smoke prevention.

Mr. Whittlesey discussed the experiments which had been tried at the Public Service Corporation power plant in the effort to comply with smoke ordinances. He mentioned as most effective the change which had been made at the Newark plant from bituminous coal to a high-grade semi-bituminous coal, which was practically smokeless when properly used. Mr. Whittlesey exhibited a number of charts showing curves of smoke density measured according to the Ringelman chart. These curves showed that the density of smoke varied considerably throughout the day in an irregular manner. On some of the charts the effect of the coming on of the peak loads could be traced in the increase of smoke. In the discussion of this paper Robert H. Kuss, assistant smoke inspector of Chicago, described a smoke-recording device which automatically made a continuous record of the density of smoke produced by the stack to which it was connected. In this device samples of smoke from the stack were conducted through a tube of small more and made to issue from a narrow slit so as to impinge upon a paper ribbon wound on a drum driven by clockwork.

The Wednesday evening session was devoted to informal discussions on mechanical stokers, steam jet and other smoke prevention devices.

At the Thursday morning session Richard B. Watrous, of Washington, D. C., secretary of the American Civic Association, gave an address on "Smoke Versus City Beauty." He stated that the damage done to property in the United States amounted to $500,000,000 per annum. This included damage to interior decorations and furnishings, as well as to the outside of buildings. He commended the efforts recently made at Pittsburg to reduce the smoke evil, and stated that Pittsburg could no longer truly be said to be the smokiest city.

C. D. Young, assistant engineer of motive power of the Pennsylvania Lines, west of Pittsburg, explained the difficulties attendant upon smoke prevention in railway work. He referred to the frequent necessity of quickly starting up a locomotive which might be standing in the roundhouse with its boiler cold, and to the sudden changes of load put on locomotives in service by change of grade, unexpected starts and stops and the resistance of reverse curves in freight yards, for example. It was not unfrequently necessary for the locomotive fireman to shovel from 5,000 to 6,000 pounds of coal per hour, and this too from a moving platform, which increased the difficulty of the work. Mr. Young then told of the experience of the Pennsylvania Railroad in the use of mechanical stokers.

The discussion on railway smoke was continued at the Friday morning session, which was attended by representatives of the Pennsylvania and Erie Railroads and the Central Railroad of New Jersey. Mr. F. T. Howley, general road foreman of engines of the Erie Railroad, described the Erie's system of instructing firemen, and stated that no railroad was making greater efforts in the prevention of smoke.

The following officers were elected: President, Daniel Maloney, Newark, N. J.; vice president, J. P. Brown, Indianapolis, Ind.; secretary-treasurer, R. C. Harris, Toronto, Canada. The next convention will be held in Indianapolis in September, 1912.

International Municipal Congress and Exposition.

The prospects for the International Municipal Congress and Exposition, to be held in the Coliseum and Armory at Chicago, Ill., September 18 to 30, 1911, are very bright. The handsomely illustrated announcement issued early in June shows a good organization with John M. Ewen at its head, John MacVicar as commissioner general and Edward H. Allen as general manager. The list of delegates already appointed from many cities in the country is large and the exhibits which the cities propose to make are many and attractive. In addition there will be many valuable exhibits made by commercial firms making and dealing in municipal machinery and supplies.

The scope of the exposition covers all lines of municipal activity and is sufficient to interest every citizen.

Information about details can be obtained on application to the officers of the exposition, 1107 Great Northern Building, Chicago, Ill.

Calendar of Technical Meetings.

South Carolina Good Roads Association.—Annual convention at Spartansburg, S. C., August 10-11. Fingal C. Black, secretary, Columbia, S. C.

American Association for Highway Improvement.—First annual convention at Richmond, Va., September 12-15. Logan Waller Page, president, U. S. Office of Public Roads, Washington, D. C.

The International Association of Municipal Electricians.—Annual convention, St. Paul, Minn., September 12-15. Clarence George, secretary, Houston, Texas.

International Municipal Congress and Exposition.—Coliseum, Chicago, Ill., September 18-30. Curt M. Treat, secretary, Great Northern Building, Chicago, Ill.

Fourth International Good Roads Congress.—Chicago, Ill., September 18 to Octo-

ber 1. J. A. Rountree, secretary, Birmingham, Ala.

International Association of Fire Engineers.—Annual convention, The Auditorium, Milwaukee, Wis., September 19-22. James McFall, secretary, Roanoke, Va.

American Society of Municipal Improvements.—Grand Rapids, Mich., September 26-29. A. Prescott Folwell, secretary, 239 West Thirty-ninth street, New York City.

League of American Municipalities.—Annual convention, Atlanta, Ga., October 4-6. John MacVicar, secretary, Des Moines, Iowa.

National Municipal League.—Annual meeting, Richmond, Va., November 13-17. Clinton Rogers Woodruff, secretary, North American Building, Philadelphia, Pa.

Technical Meetings.

The program for the convention of the Ohio Electric Light Association, at Cedar Point, Ohio, July 25-28, included the following papers: President's address, E. H. Bell, Youngstown, Ohio; "Why the Central Station Should Take Over the Isolated Plant," Waldo Weaver, Tippecanoe City, Ohio; "Systematic Central Station Records," O. B. Reemelin, Dayton, Ohio; "Ornamental Street Lighting," . A. Doeller, Dayton, Ohio; "The Utility Law and Its Application to Electric Light Companies," D. L. Gaskill, Greenville, Ohio; "Pumping Water for Municipalities and for Irrigation by Electricity,' B. H. Gardner, Dayton, Ohio; "Report on Insurance Rates for Electric Light Stations in Ohio," D. L. Gaskill; "The Use of Tungsten Lamps in Sign and Outline Lighting," W. B. Gauby, East Liverpool, Ohio; Committee Reports on Meters, Motor Applications and Electrical Transmission.

The organizing committee of the sixth congress of the International Association for Testing Materials has elected Dr. Henry M. Howe president; Mr. Robert W. Lesley, vice president; Mr. H. F. J. Porter, secretary, and Prof. Edgar Marburg, treasurer.

At the regular monthly meeting of the American Society of Engineer Draftsmen, held at the Engineering Societies Building, 39 West Thirty-ninth street, New York, a paper on "The Development of the Automatic Machine" was presented by C. A. Clark, M. E., of Toledo, Ohio.

The North Georgia-North Carolina Good Roads Association has been organized to bring about co-operation in road building in the territory embraced. The following are the officers of the organization: Albert M. Tumlin, Cave Spring, Ga., president, and J. D. McCartney, Rome, Ga., secretary.

It is announced that the proceedings of the Congress of Technology, held in Boston, April 10-11, will be published. The single volume of about 300 pages, which will be sold at a moderate price, will contain the seventy odd technical papers relating to many fields of industry, which were read at the celebration of the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology.

The Maine Society of Engineers has broadened its requirements to admit to membership civil, mechanical, mining, electrical and chemical engineers, surveyors, architects and other persons belonging to a technical profession. The following are the officers of the society: Cyrus E. Babb, of Augusta, president; Walter E. Sawyer, of Lewiston, vice president; Frank E. Pressey, of Bangor, secretary; Harold S. Broadman, of Orono, treasurer. The directors are: E. E. Jordan, of Portland; Philip E. Combs, of Bangor; E. E. Greenwood, of Skowhegan; Moses Burpee, of Houghton, and Charles A. Mixer, of Rumford Falls.

At the annual meeting of the National Firemen's Association, to be held at St. Louis, Mo., September 25, 26 and 27, 1911, the following are some of the papers which will be read: "Fire Apparatus, Past, Present, and a Glimpse Into the Future," by ex-Chief George C. Hale, Kansas City, Mo.; "Should not the chief of the fire department be consulted and apprised of all building permits and have power to compel the cleaning up and building of stairways, etc.? Should not stairways and elevators be built separate, enclosed and fireproof? Should not warehouses and bad risks space be limited to certain sizes and buildings, separated by fire walls, and laws rigidly enforced?" by Captain James Crape, Engine Company No. 19, Chicago, Ill.; "Solid vs. pneumatic tires on motor-driven apparatus from points of speed, safety and ecenomy," by T. E. Smith, Akron, Ohio; "Is the revolving gear or rotary-style pump, or reciprocating or vertical type, as used on steam fire engines, best suited for the motor-driven apparatus of the day, from the points of simplicity of construction, economy of operation and durability of machine?" by Thomas H. Robinson, Washington, D. C.

The New York Cement Show will be held in Madison Square Garden, the recent sale of that property not taking effect until after the date of the show.

Instruction in Highway Engineering.

New graduate courses in highway engineering will be offered at Columbia University next fall, under Prof. A. H. Blanchard, M. Am. Soc. C. E., who was until recently associate professor of civil engineering at Brown University and deputy engineer of the State Board of Public Roads, of Rhode Island. These courses are to be designed for technical graduates who have already had a four years' course in civil engineering. The course has been planned to include the following:

FIRST YEAR.

Processes of Industrial Chemistry.
Dynamical and Structural Geology.
Advanced Highway Engineering.
Materials of Highway Engineering.
Seminary in Current Highway Engineering Literature.

Lectures by Highway Engineers, Chemists and other Experts.
Mechanical Appliances Used in Highway Engineering.
Highway Bridges and Culverts.
Road Surveying, Drafting and Designing.

SECOND YEAR.

Industrial Chemical Laboratory.
Lithology, Petrology and Petrography.
Advanced Highway Engineering.
Highway Laws and Systems of Administration.
Seminary in Current Highway Engineering and Literature.
Lectures by Highway Engineers, Chemists and other Experts.
Road Material Laboratory.
Management Engineering.
Street Surveying, Drafting and Designing.

Technical Schools.

The College of Engineering of the University of Illinois, at the commencement exercises on June 14, 1911, conferred the bachelor's degree in engineering upon 202 men, the master's degree upon nine men, and the professional degrees of Civil Engineer, Mechanical Engineer and Electrical Engineer upon eight, four and five men, respectively. The honorary degree of Doctor of Engineering was conferred upon Mr. Ralph Modjeski, bridge engineer.

Dr. Michael I. Pupin, professor of electromechanics at Columbia University, New York City, has been designated to serve as director of the Phoenix Research Laboratories of the university. In this capacity Dr. Pupin will have general charge of the research work of the department of physics.

Dr. Arthur Stanley Mackenzie, professor of physics at Stevens Institute of Technology, Hoboken, N. J., has been elected president of Dalhousie University, at Halifax, N. S.

Prof. Louis D. Huntoon, M. Am. Inst. M. E., formerly of the department of mining and metallurgy at Sheffield Scientific School, Yale University, has opened an office at 42 Broadway, New York City, as a consulting engineer.

The Illinois legislature, which recently adjourned, appropriated for the support of the State University for two years, following July 1, the sum of $3,500,000, of which about $500,000 is for new buildings. The College of Engineering received specific appropriations for maintenance amounting to $192,000 in addition to $200,000 for a building. The department of mining engineering received appropriations of $35,000 for maintenance and $25,000 for equipment. The legislature also authorized a tax of one mill upon the assessed value of the state for the future support of the university.

Personal Notes.

A. C. D. Blanchard has been appointed city engineer of Lethbridge, Alberta, Canada.

William H. Catin has been named by Governor Dix as superintendent of highways of the state of New York.

August Baltzer has been appointed city engineer of Kenosha, Wis., succeeding Mr. Robert H. Moth, resigned.

Ralph Modjeski, M. Am. Soc. C. E., has been awarded the honorary degree of Doctor of Engineering by the University of Illinois.

Osborn Monnett has been appointed chief smoke inspector of the city of Chicago. Mr. Monnett was formerly western editor of *Power*.

E. B. Cushing has been appointed inspector of public works of Los Angeles, Cal., with a salary of $3,600 a year. The position has only recently been created.

John T. Miller has been appointed chief engineer of public works of the state of Ohio. He succeeds James Marker, recently appointed highway commissioner.

Allen Hazen, of New York, has been retained by the city authorities of San Francisco to advise with them regarding the Hetch-Hetchy water supply project.

Gen. Theodore A. Bingham has resigned his office of chief engineer of the Bureau of Highways, Borough of Manhattan, New York City, to which he was appointed recently.

L. R. Bowen has been appointed engineer of the street department of the city of St. Louis. Mr. Bowen has been engineer for the board of public improvements for a number of years.

George H. Benzenberg, past president of the American Society of Civil Engineers, was awarded the honorary degree of Doctor of Science at the commencement exercises of the University of Wisconsin.

Henry B. Drowne, Assoc. M. Am. Soc. C. E., has resigned as instructor in civil engineering at Brown University to accept an appointment as instructor in highway engineering at Columbia University, New York.

Louis C. Kelsey, M. Am. Soc. C. E., of Portland, Ore., has been appointed consulting engineer to the Oregon State Board of Health, to consult on matters relating to water supply, sewerage and sewage disposal.

Clifford M. Hathaway, Jun. Am. Soc. C. E., has resigned from his position with the Rhode Island State Board of Public Roads to accept a position as assistant engineer with A. H. Blanchard, consulting highway engineer, Providence, R. I.

P. H. Everett, of Lynn, Mass., has been appointed assistant engineer of the Highway Commission of California, at a salary of $2,750 a year. Mr. Everett is the third highway expert which southern California has taken from Massachusetts.

Arthur P. Noyes has been appointed city engineer and superintendent of public streets of Vallejo, Cal. Mr. Noyes was formerly city engineer. The recent adoption of the commission form of government led to the combination of the two offices above named.

H. F. Porter, consulting engineer, New York City, has been selected by the organizing committee of the Sixth Congress of the International Association for Testing Materials to act as its local secretary. The congress will be held in the United States in the early part of September, 1912.

Messrs. Leonard Metcalf and Harrison P. Eddy, M's. Am. Soc. C. E., consulting sanitary engineers, of Boston, Mass., announce that they have opened a branch office in Chicago, Ill. Mr. William T. Barnes, Assoc. M. Am. Soc. C. E., one of the principal assistant engineers of the firm, will have charge of this office.

Charles A. Hague, consulting hydraulic engineer, of New York City, died on June 25. During recent years he had devoted much of his time to the installation of pumping machinery for water works. He was a member of the American Society of Civil Engineers, the New England Water Works Association and the American Water Works Association.

James R. Marker, chief engineer of the Ohio State Board of Public Works, has been appointed state highway commissioner of Ohio. Mr. Marker has announced the following appointments: Deputy commissioners, Clifford Shoemaker, Clyde T. Morris and A. H. Hinkle. Messrs. Morris and Hinkle are now professors in the Engineering College of the Ohio State University.

Use of Bitulithic in California.

Bitulithic has been adopted for Orange Grove avenue, Pasadena, Cal., after three years' consideration of the kind of pavement to be laid. The boulevard is about three miles long and fifty feet wide, and will be remembered by visitors to Southern California as one of the best and finest boulevards in the state. On this street are the winter residences of many of the most prominent citizens of the eastern and middle western parts of the United States.

New Portable Plant for Road Builders.

To meet the requirements of bituminous macadam road builders the Iroquois Iron Works, Buffalo, N. Y., has designed a self-propelled asphalt-concrete mixing machine, weighing only 10 tons, which has a capacity of 800 square yards of 3-inch material per day of ten hours. The manufacturers believe that this plant, while available for work on a large scale, will solve the problem of profit making on contracts which do not justify very costly outfits. The wheel base of the machine is only 12½ feet, and it can be shipped on a railroad car.

The engine and boiler of the mixer are the same as those of the Iroquois 8-ton roller. Link belt and bucket elevators are provided for both hot and cold material. The dryer is of the revolving drum type with a screen at the delivery end. The steam-jacketed mixing trough, measuring box and asphalt measuring bucket are of the same width, and so arranged that the stone and heated asphalt are delivered together in a broad stream at the rear of the plant, and there forced by the revolving blades through a trough sufficiently high to permit of easy loading to distributing carts or barrows. The engine, boiler, dryer and mixer are all on one level, the platform being formed of 9-inch 15-pound channel. The first two of these machines manufactured were sold last week to Troy (N. Y.) and Baltimore contractors.

Lead Wool for Jointing Water Pipes.

The cast lead joint for water pipe has defects which it has been impossible to overcome, but the newer form of lead wool or shredded lead has eliminated them.

Molten lead cannot be calked the full depth of the joint, the only calking possible being done on the outside after the lead has cooled and this calking cannot possibly be made effective for more than ½ inch. Molten lead must contract or shrink when it cools and therefore the only safeguard against leakage, in fact the entire strength of a cast joint is confined to the ½ inch or less calked lead at the top or outside of the joint.

Lead wool is put up in strands which should be placed in the joint one at a time and each strand thoroughly calked before the next strand is added.

Every portion of a lead wool joint is calked, every ounce of lead adds to the strength of a joint and this must result in a joint much stronger, more durable, more elastic and better in every way than a cast joint. It will stand far greater pressure than can be applied to cast iron pipe and in fact has been subjected to tests of over 2,000 pounds per square inch.

The manufacturers make no claims for lead wool which have not been fully demonstrated by practical test and by results obtained from its use by water and gas companies in this and other countries.

The Consolidated Gas Company of New York has recently placed an order for 100 tons of lead wool.

Attention is called to two important points; the saving of at least one-third of the material and the great saving in repair work as compared with the cast joint now in use.

use. The saving is shown by the comparison of the number of pounds of lead necessary with cast lead and with the lead wool. Thus a 6-inch pipe requires 9 pounds of cast lead per joint or 6 pounds of lead wool as a maximum; a 16-inch pipe requires 30 and 20 pounds respectively; a 36-inch pipe 103 and 65 pounds respectively. About the same ratio is shown in other sizes of pipe.

Lead wool and pneumatic calkers greatly reduce the cost of jointing cast iron pipe. In a recent paper before the American Gas Institute, C. C. Simpson showed that the pneumatic calkers could not be used satisfactorily with cast lead, for they saved no time and the lead could not be calked back more than ½ to ¾ inch from the face of the hub. Greater pressure than that necessary to do this resulted in split hubs. The use of lead wool, however, gave the pneumatic calker its opportunity, and, in addition to the saving

in lead, a saving in time of making a joint resulted, which was about one-third, or a reduction in labor cost from $3.17 to $2.15 average per joint on 36-inch pipe.

The United Lead Co., Trinity Building, New York City, has some very interesting literature on this subject, including the paper referred to.

The Automobile and the Road.

The first automobiles with their low speeds did little damage to the macadam surfaces, but when speed increased and motors became more powerful the rear wheels of the cars ground the brittle macadam like an emery wheel. Engineers were dismayed to see their costly surfaces, built, as they thought, to endure many years of travel, ruined in a single season. The crushed stone was scraped away by the clinging tires and scattered to the winds by the draft of the cars. The Office of Public Roads in the Department of Agriculture, experimenting on a Long Island highway with high-powered automobiles, settled beyond all doubt that this was the source of the damage when it discovered that the driving wheels of the automobiles revolved considerably more times per mile than front wheels of the same diameter, indicating a certain amount of "slip." The effect of this "slip" on a dry, brittle macadam road surface hardly needs to be demonstrated. The lack of tenacity in ordinary macadam under such strains was responsible for its inability to endure this type of traffic.

It had once been thought that it was the vacuum caused by the passage of the cars which sucked the dust out of the roadway, but with this scientific demonstration to settle the question as to the real cause of the injury, road engineers everywhere turned to the problem of building more tenacious road surfaces. French engineers, years before, had discovered the desirability of binding roads with tar compounds as a dust preventive, and American engineers, following the French experiments, developed what has now become widely known as the tarviating process. The tarvia which is used is a viscid bitumen derived from coal tar. Its function is to fill the voids in the macadam and enclose the stone in a tough plastic matrix. The action is somewhat like that of cement in concrete. The tarvia concrete is not rigid or brittle but retains a certain elasticity and capacity for yielding to strains. On this plastic surface the driving wheels simply roll down the surface and make it smoother with use. They cannot tear loose the stone from the plastic matrix, and they have little or no pulverizing effect.

In appearance tarviated macadam resembles sheet asphalt. It is not designed to withstand the strains imposed on sheet asphalt streets, but it is satisfactory for the lighter traffic of suburban towns, boulevards and automobile highways.

WEST WALNUT STREET, SAYBROOK, OHIO, BUILT WITH TARVIA X.

The tarvia processes, of which there are several, provide the answer to the typical macadam road problems. The problem of maintaining an old and well-worn macadam road, for example, is solved by an application of tarvia B, the lightest and thinnest of the tarvias, designed primarily for dust suppression. This tarvia B process will save an old road for a year, usually making water sprinkling unnecessary, and preventing erosion by water or attrition by automobile traffic.

For more thorough applications there is the tarvia A process, usually employed for roads where a smooth and handsome contour is desired, as in parks, cemeteries, boulevards, etc. Tarvia A is denser than tarvia

B and naturally has more tenacity and bonding power. It is somewhat more expensive, because it is so dense when cold that it cannot be poured and requires the use of heating apparatus to prepare it for application. Like tarvia B, it requires maintenance expenses, makes the roads automobile-proof, and prevents the formation of dust.

The third tarvia process is for new roads or old roads that are being reconstructed or resurfaced. This gives opportunity to use tarvia X, an exceptionally dense and tough bitumen of great durability and bonding power. Like tarvia A, it requires heating for application. The use of the dense tarvia makes possible the placing of larger stones near the surface than would otherwise be possible. Engineers have recognized the desirability of using as large stone as possible at the surface, because large stone is naturally capable of taking more wear than fine stone. Formerly traffic would cause a continuous grinding and turning movement of the large stone so near the surface, just as it causes an old road to ravel and break up when the protective carpet of surface screenings has been worn away. When the tarvia binder is used the large stone can be held firmly to its work near the surface and much more service is thus obtained from the same amount of stone.

Roads built with tarvia X do not change contour even when neglected. They require occasional inexpensive surface treatments to keep them smooth and dustless. Tarvia B is frequently used to good advantage to keep the surface in first-class condition.

In this prolongation of the life of the road lies the real cheapness of the road processes. By these various tarvia processes road engineers have found economical methods of making their roads automobile-proof and these processes are now practically standard among experienced road authorities.

ROAD IN EDGEWATER PARK, CLEVELAND, TREATED WITH TARVIA A.

The Simplex Water Meter.

The Simplex Valve and Meter Co., 112 North Broad street, Philadelphia, have perfected a type of meter which is important for its ability to measure all uows from zero to any desired maximum without limitations.

It consists of some form of orifice such as a Venturi tube, pitot tube in a water main, any form of conduit, canal, or even weir, and having suitable pipe connections with it. The apparatus consists of a mercury float chamber, and resting in which is a float of such variable cross section that its movement is in direct ratio to the flow of water through the Venturi tube, pipe, conduit, canal or weir.

The movement of the float actuates a revolving shaft to which is attached a hand pointing to a fixed dial with uniform graduations.

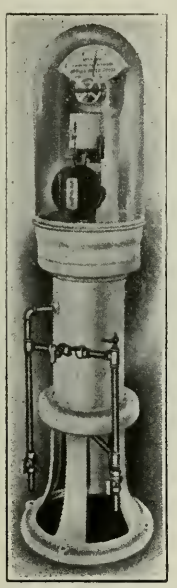
Attached to the shaft and moving in proportion to the angular deflections of it is a pen in contact with a rectangular chart wrapped on a revolving cylinder; also a traction wheel, which passes over the face of a revolving disc, the traction wheel being geared to a train of wheels operating a ser-

ies of small dials similar to that of a house gas or water meter. Both the cylinder and the disc are operated by an eight day marine clock.

The traction wheel is specially constructed so that its movement while in contact with the face of the disc is free from rubbing friction.

It is evident that the movement of the traction wheel, as well as the movement of the pen, being in direct ratio to the angular deflection of the shaft, are in direct ratio to the movement of the float and therefore to the flow of water through the conduit.

As both the disc and chart cylinder are operated by the clock, their angular movements are equal for equal increments of time.



SIMPLEX WATER METER.

The chart is uniformly graduated; the abscissas representing hours and the ordinates the rates of flow.

The total flow register is of the five figure type with small circular dials. For 3-inch to 10-inch Venturi meters inclusive the lowest figure of the dial is 1,000 gallons. For 12-inch to 24-inch inclusive the lowest dial is 10,000 gallons. For 30-inch to 60-inch inclusive the lowest figure is 100,000 gallons. These are for standard Venturi meters whose throat diameter is one-half the diameter of the main. For special sizes the dials are sometimes changed and while the standard is generally taken as United States gallons, the graduations may be in pounds, cubic feet or any other unit that may be specified.

The rate of flow dial, chart, chart recorder and total flow register are all enclosed in a dust-proof glass dome resting on a felt gasket. This feature has the advantage of fully exposing the mechanicism to view at all times, and has been adopted in preference to a metal case, which could just as readily have been used. The accompanying photograph shows one of the meter installations.

The Simplex Company has a booklet which in addition to describing their meters, gives methods for calculating sizes of pipes and tables of diversions.

Non-Corrosive Sheet Steel.

The success on non-corrosive steel culverts has led to the promotion of the non-corrosive metal for other purposes. One of the products of this nature is the "Vismera" sheet of the Inland Steel Company, of Chicago. It is made of very pure steel and thus the danger of corrosion is greatly reduced. The sheets are used in making culverts, roofs, tanks for over- and underground use, siding, eaves and other architectural uses, ash and garbage cans, etc. They are supplied blue annealed, box annealed and galvanized, of standard sizes, and either plain or corrugated.

The Boyd Automobile Combination Chemical Engine and Hose Wagon.

The combination chemical engine and hose wagon, motor propelled, has come to be recognized as the most efficient of all fire fighting equipment. Fire chiefs are almost unanimous in their belief in the value of this piece of apparatus, by reason of the quickness with which it reaches the fire and its ability to "get there" ready for instant use, regardless of weather or road conditions.

The firm of James Boyd and Bro., 23rd and Wharton, Philadelphia, have for a number of years manufactured a thoroughly efficient and durable line of horse-drawn fire apparatus. They have recently turned their attention to the motor equipment and have placed on the market an automobile chemical engine and hose wagon which possesses the features of durability and careful construction which characterized their horse-drawn apparatus.

The accompanying photograph shows their "Type B-701" equipment. The long wheel base (123-inch) with the heavy substantial chassis construction may be noted from the photograph. Extra large wheels (36x5 and 36x6) are also features which contribute to the lessening of vibration due to uneven road surfaces and therefore to the added life of the equipment.

The transmission is of the sliding gear power. The transmission is of the sliding gear selective type; three speeds forward and reverse. A double chain drive is provided, giving a maximum of power with less wear in the parts due to the sudden starting and stopping necessary in fire service. The machine will attain a speed of 40 to 50 miles per hour.

The other equipment includes the following: Two 30-gallon copper tanks with 200

feet of ¾-inch chemical hose and shut-off nozzle attached; two polished brass acid receptacle holders; one 20-foot extension ladder; one door opener; one crowbar; one axe; two fire department lanterns; one 13-inch engine bell; two 10-inch acetylene headlights; body has capacity for 1,200 feet of 2½-inch rubber lined cotton fire hose.

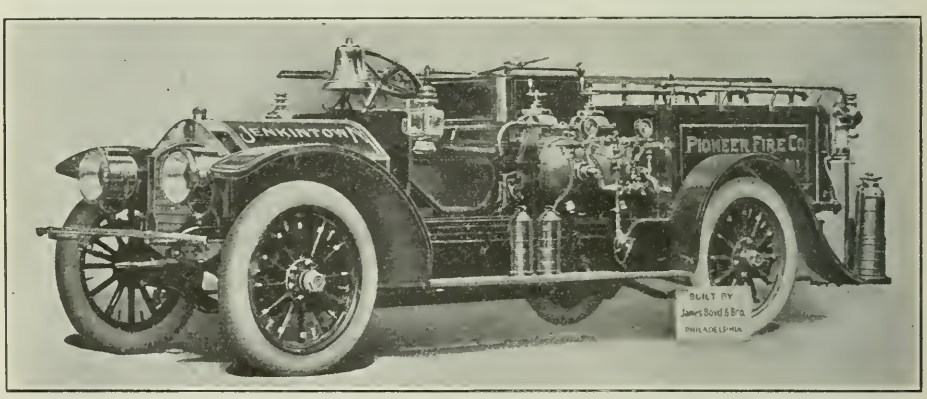
The Cement Industry in 1910.

The statistics of cement production in 1910, as reported by Ernest F. Burchard, of the United States Geological Survey, indicate that the cement industry ranks within the first eight extractive industries in the United States, the value of the cement produced being exceeded only by the value of th coal, pig iron, petroleum and gas, clay products, copper, gold and stone.

On the first of January, 1911, according to responses to telegraphic requests sent by the Survey to the larger cement companies, it was apparent that the Portland cement industry had made a new high record in 1910, and it was then estimated by Mr. Burchard that the production for the year might reach 75,000,000 barrels. Few other estimates ventured beyond this limit, and that it has been exceeded by more than half a million barrels, as is shown by the following statistics, will doubtless prove surprising to nearly every one closely in touch with the cement industry.

The total quantity of Portland, natural, and puzzolan cements produced in the United States during 1910 was 76,934,675 barrels, valued at $68,052,771. Compared with 1909, when the production was 66,689,715 barrels, valued at $53,610,563, the year 1910 showed an increase of 10,244,960 barrels, or 15.3 per cent., in quantity, and of $14,442,208, or 26.9 per cent., in value. The increase in quantity is one of the largest ever recorded, and the fact that the increase in value was proportionately higher indicates that trade conditions were slightly more satisfactory than during 1909.

The total production of Portland cement in the United States in 1910, as reported to the Geological Survey, was 75,699,485 barrels, valued at $67,506,479. This quantity, reduced to tons, is equivalent to 12,841,430 long tons, valued at $5.26 a ton. Compared with the output of pig iron for 1910, which was 27,298,545 long tons, having an estimated value of $419,851,622, or $15.38 a ton, the production of Portland cement approximates 47 per cent. of the quantity of pig iron and 16 per cent. of its value. In 1909 the production of Portland cement was 64,991,431 barrels, valued at $52,858,354; the output for 1910 therefore represents an increase in quantity of 10,708,054 barrels, or 16.5 per cent., and in value of $14,648,125, or 27.7 per cent. The average price per barrel in 1910, according to the figures reported to the Survey, was a trifle less than 89.2 cents. This represents the value of the cement in bulk at the mills, including the labor cost of packing, but not the value of the sacks or barrels. This average price is 16.5 cents higher than the average price received for cement in the Lehigh district, 14.2 cents higher than that in the eastern states, 1.8 cents lower than that in the central states, 13.8 cents lower than that in the western states, 4.8 cents lower than that in the south, and 48.8 cents lower than that on the Pacific coast. In the average price for the country is included the value of nearly 75,000 barrels of white Portland cement, which sold for an average of $2.86 a barrel.



BOYD MOTOR FIRE APPARATUS.

Publications Received.

Municipal Franchises. A description of the terms and conditions upon which private corporations enjoy special privileges in the

streets of American cities. By Delos F. Wilcox, Ph. D. In two volumes, $5.00 each. Engineering News, Book Dept., New York.

Flies and Mosquitoes as Carriers of Disease, by Wm. Paul Gerhard, C. E. Twenty-five cents. Published by author, 39 Strong Place, Brooklyn, N. Y.

Pittsburg Main Thoroughfares and the Downtown District. A report prepared under the direction of the committee on city planning. By Frederick Law Olmstead.

Second Annual Report of the Association for Standardizing Paving Specifications. Meeting held in New York January 10 to 14, 1911. Five dollars. John B. Hittell, secretary, City Hall, Chicago, Ill.

Eighth Annual Report of the Superintendent of the Perth Amboy (N. J.) City Water Works, for 1910. A. H. Crowell, superintendent.

Forty-fifth Annual Report of the Water Commissioners of Newburgh, N. Y., for 1910. Curtis Stanton, superintendent.

Report of the Superintendent of Coast and Geodetic Survey. Showing the progress of the work from July 1, 1909, to June 30, 1910. Department of Commerce and Labor. O. H. Tittman, superintendent.

Seventh Annual Report of the Water Board of the City of Auburn, N. Y., for 1910. J. Walter Ackerman, superintendent.

Fourteenth Annual Report of the Water Commissioners of the Town of Winchendon, Mass., for 1910. William F. Clark, superintendent.

Forty-first Annual Report of the Chief Engineer of the Water Department of Wilmington, Del., for 1910. John A. Kienle, chief engineer.

Electricity in the Development of the South. An address giving observations on the importance of federal incorporation for small companies engaged in interstate commerce. By George Westinghouse, Pittsburg, Pa.

Inheritance Tax. A bulletin of the extension division of the University of Wisconsin. Five cents. Published by the University, Madison, Wis.

The Man in the Pigeonhole. A satire on slavery to party lines in municipal elections. By John McAuly Palmer. National Municipal League, 703 North American Bldg., Philadelphia.

The Relation of Civil Service Reform to Municipal Reform. By Hon. Carl Schurz, New York. National Municipal League, Philadelphia, Pa.

Legal Liability as Trustees of City Officials and Employes, Under the Charter of Greater New York. Five cents. By William J. Curtis, Bureau of Municipal Research, 261 Broadway, New York City.

The New Era in Education. A study in the psychology of correspondence methods and instruction. By Rev. Joseph H. Odell, D. D. International Correspondence Schools, Scranton, Pa.

Fifty-third Annual Report of the Louisville Water Company, Louisville, Ky., for 1910. Theodore A. Leisen, superintendent.

Steam Power Plant Engineering. By G. F. Gebhardt. Third edition, revised and enlarged. Six dollars. John Wiley & Sons, New York City.

Sewerage, the Design, Construction and Maintenance of Sewerage Systems. By A. Prescott Folwell. Sixth edition, revised and enlarged. Three dollars. John Wiley & Sons, New York City.

Twenty-fifth Annual Report of the State Board of Health of Ohio, for 1909. C. O. Probst, M. D., secretary.

Good Engineering Literature. What to read and how to write with suggestive information on allied topics. By Harwood Frost. One dollar. Chicago Book Company, 226 South LaSalle St., Chicago, Ill.

Preliminary Report on Storage Reservoirs at the Headwaters of the Wisconsin River. and their Relation to Stream Flow. By C. B. Stewart, conculting engineer, Madison, Wis.

A Study of the Water Supplies of the Isthmus of Panama. By John R. Downes, physiologist to the Isthmian Canal Commission, Mount Hope, C. Z.

Trade Publications.

Byerley & Sons, Cleveland, Ohio, manufacturers of Byerlyte Asphalt, have just issued two very attractive booklets dealing with the application of Byerlyte in waterproofing and paving.

The July Bulletin of the Universal Portland Cement Co., Chicago, Ill., contains a number of interesting photographs and descriptive matter concerning cement power house, coal bunkers, bridges, buildings, etc. Some country roads in Ohio which have been constructed of concrete are shown and descriptions of them are given.

The Chicago Portland Cement Co., 30 North LaSalle street, Chicago, have issued the first number of the "Cement Dealer," a publication devoted to establishing and maintaining a thorough understanding and a friendly attitude between the manufacturer and the dealer in cement. It will be published periodically and will contain information of interest and value to the cement dealer.

The Ansonia Brass and Copper Co., 99 John street, New York, have a booklet descriptive of "Tobin Bronze." The metal is used for bare and insulated copper wires and cables for trolley roads, electric lighting stations, power transmission lines, etc. Various tests of the material are noted together with instructions for ordering and manipulating.

The Delta Star Electric Company, 617-631 West Jackson boulevard, Chicago, have issued a sectional catalogue of transformers, fuses, and Pittsburg Automatic Mazda Street Series Lighting System.

The July issue of "Paving and Roads," the publication of the Texas Company, 17

Battery Place, New York, contains the following articles: Sheet asphalt without binder; asphalts, characteristic tests, by H. Tipper; new method of macadam road construction; Wellington street, Toronto, Canada; cost tables for road oiling.

The L. M. Booth Company, 136 Liberty street, New York, have a very attractive illustrated booklet describing the Booth Softener. Installations of the softener are shown together with a number of sectional photographs which illustrate the working principles of the apparatus. The details of operation are clearly shown and are further explained by an exceptionally clear description.

The McGuire Incinerator is a new garbage destructor, testimonials regarding the operation of which in Hobart and Tulsa, Okla., and Marlin, Tex., are sent out by W. H. McGuire, Hobart, Okla., the inventor.

Trade Notes.

ASPHALT.

Oklahoma City, Okla.—Special.—The secretary of state has issued a charter to the Oklahoma Asphalt and Refining Co., of Ardmore, Okla. The capital is $50,000 and the incorporators are J. T. Paschal, T. W. Carbutt and C. G. Spindler, all of Ardmore, Okla. This company will engage in the paving business. It controls large bodies of the native asphalt which is found in extensive quantities at Ardmore.

BRICK.

Baker, Oregon.—Special.—There has been discovered near the city and adjacent to a railroad, a very large body of fire, tile and pottery clays. Owing to the scarcity of these clays in the Pacific Northwest and the superior quality, the industry is assured of a great future. The Eureka Fire Clay, Brick and Tile Company, a corporation of Oregon, with headquarters in Baker, was recently organized for the purpose of manufacturing fire brick, tile and pottery of these clays and will erect a plant for that purpose in the near future. J. I. Wade is manager.

MACHINERY.

Columbus.—Special.—Frank T. Packard, architect, will receive bids at 10 a. m., August 12, for furnishing materials and installing feed wires and lights at the Ohio State Sanatorium, near Mount Vernon.

Pittsburg, Pa.—Joseph G. Armstrong, director of public service, will receive bids at 4 p. m., August 10, for furnishing coal and ash handling equipment at the Aspinwall pumping station; and for two water tube boilers, two mechanical stokers, flue and appurtenances at the Ross pumping station.

Austin, Tex.—The contract for constructing a dam and hydraulic plant to cost about $1,000,000 has been awarded to William D. Johnson, Hartford, Conn., subject to ratification by a referendum vote.

SEWERS.

Washington, D. C.—Consul-General Sammons, of Yokohama, Japan, reports that the authorities of Tokio have decided to install a complete sewerage system to cost between $17,000,000 and $20,000,000. Holders of American patents on sewer pipe should have the same registered in Japan. Address inquiries to Bureau of Manufacturers, No. 6934.

WATER.

Willow Okla.—The secretary of state has issued a charter to the Willow Water Works Co. The capital is $5,000 and the incorporators are W. O. Dodson, C. C. Holden, H. C. Webb, L. G. Cousins, all of Willow, and Zack T. Pryse, of Mangum, Okla.

CEMENT.

Neligh, Neb.—Bids will be received August 5 for furnishing cement for city use during the ensuing year. O. S. Hauser, city clerk.

Patents on Apparatus and Tools for Cement Workers.

867,819. Cement worker's tool. Frederick W. Grundmann, St. Louis, Mo.

868,238. Tamping bar. Ernest W. Wheeler, Bay City, Mich.

889,240. Protective setting for metallic bodies in concrete. Roman T. Kanski, New York, N. Y.

897,771. Tamping machine. Paul Olson, Stoughton, Wis.

899,185. Socket for use in concrete work. Elmer A. Purdy, Amboy, Ill.

923,188. Hanger socket for reinforced concrete. Frank N. Kneas, Norristown, Pa.

923,834. Cement worker's tool. John T. Harrop, Garfield, N. J.

926,886. Cement bucket. Willard D. Lockwood, Schenectady, N. Y.

930,374. Cement worker's tool. John T. Harrop, Garfield, N. J.

939,071. Apparatus and process of laying cement sidewalks or similar structures. Alexander D. Ney, Aurora, Ill.

840,601. Apparatus for laying concrete sidewalks, curbs, etc. Ernest L. Ransome, New York, N. Y.

943,327. Process of treating Portland cement surfaces and product. Maximilian Toch, New York, N. Y.

945,863. Concreter's bolt. Benjamin H. Paugh, Parsons, W. Va.

946,160. Form for laying artificial stone walks. Selvin C. Smith, Waverly, N. Y.

947,469. Device for roding off cement and concrete surfaces. James R. Gorden, Portland, Ore.

985,074. Tool for cement work. Ralph L. Sohn, Arrowsmith, Ill.

985,086. Adjustable clamp, employed in structural concrete construction. Paul Wilkes, Cleveland, O.

988,457. Sidewalk tool. Winfield S. Glasscock, Neodesha, Kas.

Patents Concerning Waterproofing and Solidifying Concrete.

869,280. Means for Frost-Proofing Concrete Walls. John H. Walzl, Baltimore, Md.

872,390. Lime Hydrating Machine. John H. Van Glahn, Toledo, O.

883,683. Waterproof Portland Cement Mortar and Process of Making the Same. Richard H. Gaines, New York, N. Y.

918,388. Process of Solidifying Mortar and Concrete Formations. Robert C. Stubbs, Dallas, Texas.

929,152. Method of Making Cement, Mortar and Concrete Water Tight. Paul Meeke, Stettin, Germany.

934,061. Waterproof Cement Block. John A. Fincke, New York, N. Y.

939,072. Rock-Like Substance. Alex. D. Ney, Aurora, Ill.

954,814. Waterproof Concrete Construction. Felix P. Lawrence, St. Louis, Mo.

968,591. Process of Treating Molded (Concrete) Articles. Walter M. Newton, Wyoming, Del.

976,520. Process of Making Water-proof Portland Cement and Product. Maximilian Toch, New York, N. Y.

985,709. Method of Waterproofing Cement Blocks. David F. Shope, St. Paul, Minn.

IMPROVEMENT AND CONTRACTING NEWS

PMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Jacksonville, Fla.—August 8, 3 p. m. Grading, curbing, laying sidewalks, etc., in various parts of the city. Certified check, $500. Phillip Prioleau, city engineer; Henry Gailland, chairman committee on public works.

Americus, Ga.—Paving the principal streets, about 50,000 sq. yds. T. N. Hawkes, city clerk.

Atlanta, Ga.—August 4, 12 m. Constructing tile walks and cement steps for ten new schools. Wm. M. Slaton, superintendent of schools.

Atlanta, Ga.—August 4, 3 p. m. Altering reinforced concrete tunnel to widen West Mitchell street. R. M. Clayton, chief of construction.

Brazil, Ind.—August 8, 11:30 a. m. Constructing gravel roads in Cass and Brazil townships. E. A. Staggs, auditor.

Brookville, Ind.—August 10, 1 p. m. Constructing certain highways. Chas. A. Miller, auditor.

Brownstown, Ind.—August 7, 1:30 p. m. Constructing two roads in Carr township. H. W. Wacher, auditor.

Corydon, Ind.—August 9, 2 p. m. Constructing gravel or macadamized road in two townships. William Taylor, auditor.

Decatur, Ind.—August 7, 10 a. m. Constructing macadam roads in Washington and Kirkland townships. H. F. Michaud, auditor.

Fowler, Ind.—Aug. 7, 1 p. m. Constructing two free stone roads in Hickory Grove township Lemuel Shipman, auditor.

Frankfort, Ind.—August 12, 2 p. m. Constructing 14,460 feet of gravel road. Chas. T. Cromwell, auditor.

Greensburg, Ind.—Aug. 7, 1 p. m. Constructing macadamized road in Washington township. Frank E. Ryan, auditor.

Lafayette, Ind.—August 9. Constructing gravel roads estimated as follows: Miller road, $3,635; Kolb road, $7,474; Taylor road, $2,142; Magee road, $5,235; Jackson road, $8,628; Stewart road $4975, also a number of small concrete arches and 2,000 feet of 5-inch drain tile.

Liberty, Ind.—August 7, 2 p. m. Constructing two gravel roads in Harrison township. Clinton Gardener, auditor.

Logansport, Ind.—Aug. 8, 10 a. m. Constructing various gravel and macadam roads in Cass county. J. E. Wallace, auditor.

Logansport, Ind.—August 9, 1 p. m. Constructing two macadamized roads in Noble township. J. E. Wallace, auditor.

Martinsville, Ind.—Aug. 8, 2 p. m. Constructing macadamized road in Jackson township. J. S. Whitaker, auditor.

Newport, Ind.—August 7, 10 a. m. Constructing gravel roads in Clinton township. H. C. Payne, auditor.

Noblesville, Ind.—August 9, 2 p. m. Constructing nine gravel roads. George Griffin, auditor.

Portland, Ind.—August 7, 10 a. m. Constructing highway in Wabash township. W. Lea Smith, auditor.

Salem, Ind.—August 7, 1:30 p. m. Constructing gravel road in Franklin township. F. S. Munkelt, auditor.

Spencer, Ind.—Aug. 8, 1 p. m. Constructing macadamized road in Jackson and Jennings townships. E. W. Edwards, auditor.

Versailles, Ind.—Aug. 7, 1 p. m. Constructing macadamized road in Laughery township. Nicholas Volz, auditor.

Wabash, Ind.—August 8, 1:30 p. m. Constructing gravel roads. J. P. Noftzger, auditor.

Washington, Ind.—Aug. 7, 2 p. m. Constructing gravel road in Washington township. Thos. Nugent, auditor.

Winamac, Ind.—August 8, 12 m. Constructing road in Pulaski county. W. E. Muchenburg, auditor.

Winchester, Ind.—August 4, 10 a. m. Constructing highways in six townships, eleven roads in all. Henry S. Wood, auditor.

New Ulm, Minn.—August 5, 1 p. m. Constructing cement sidewalks and crossings. Certified check, $50. Ernst Wicherski, clerk board of public works.

St. Paul, Minn.—August 7, 2 p. m. Regulating, grading, graveling roads, sodding, etc., around cottages of the Home School for Girls, Sauk Center, Minn. Morell & Nichols, landscape architects, Minneapolis, Minn.

St. Peter, Minn.—August 14, 8 p. m. Grading and graveling several streets.

Omaha, Neb.—August 5, 12 m. Furnishing culvert pipe for one year. Certified check, $50. D. M. Haverly, county clerk.

Bridgeport, N. J.—Aug. 9, 11 a. m. Improving 7.694 miles. Certified check, $1,000. Benjamin Erickson, chairman public road committee.

Newark, N. J.—August 8, 2 p. m. Grading, laying walks, etc., in the grounds of Montclair State Normal. Certified check, 10 per cent. William G. Schauffler, president state board of education.

Woodstown, N. J.—July 31, 1 p. m. Constructing asphalt-concrete road on East and West avenues. Certified check, $1,000. E. S. Fogg, mayor.

Ashland, O.—Aug. 2, 12 m. Improving about 3¾ miles of road with crushed limestone and tar or asphalt binder. Certified check, $200. Lotta Westover, clerk county commissioners.

Ashland, O.—August 7. Paving Sandusky street. Certified check, $200. Edward Koehl, city clerk.

Batavia, O.—August 8, 12 m. Grading and macadamizing 1.12 miles of road, $6,613.26; also 2.09 miles, $12,443. Certified check, $300. County commissioners.

Bowerston, O.—Aug. 5, 12 m. Paving Maine, State and Garfield streets with brick. Certified check, $500. W. F. Utterback, clerk.

Cambridge, O.—August 4, 10 a. m. Grading and paving with brick one mile of road, $13,386.34. Certified check, $300. County commissioners.

Canton, O.—August 4, 12 m. Grading and paving with brick 2.16 miles of road, $39,132.79. Certified check, $300. County commissioners.

Chillicothe, O.—August 1, 12 m. Paving and parking Main and High streets.

Cincinnati, O.—Aug. 14, 12 m. Grading, planting, sodding, cement and sewer work,

etc., and parking of the lot surrounding the Winton Place school. Guaranty, 30 per cent. C. W. Handman, business manager board education.

Columbus, O.—August 9, 2 p. m. Constructing various roads in Franklin county. Certified checks, $200 to $1,000. John Scott, clerk board of county commissioners.

Lisbon, O.—August 1, 1 p. m. Improving Carpenter's Run road. President county commissioners.

Marietta, O.—August 2, 12 m. Grading and paving with brick, 1.57 miles of road, $16,895.44. Certified check, $300. County commissioners.

McConnellsville, O.—August 5, 12 m. Grading and macadamizing two miles of road, $16,568.50. Certified check, $300. County commissioners.

Napoleon, O.—August 4, 10 a. m. Repairing Malinta-Hamler pike. Check, $500. C. C. Meekison, auditor.

New Philadelphia, O.—August 11, 12 m. Grading and paving with brick, 2.01 miles of road, $32,299.90. Certified check, $300. County engineers.

North Robinson, O.—August 1, 12 m. Constructing about 1,300 feet of pike. Jas. E. Morton, clerk of council.

Philadelphia, O.—August 7, 1 p. m. Constructing 1,900 feet of pike road on the Huff Run road. W. C. Shott, county auditor.

St. Clairsville, O.—August 10, 12 m. Grading and macadamizing .84 mile of road, $8,429.15; grading 2.26 miles, $7,400. Certified check, $300 with each bid. County commissioners.

Steubenville, O.—Aug. 10, 12 m. Grading, sewering and macadamizing the Wabash and Bloomfield free turnpike road, bids to be considered in four sections. Certified check, $500. County auditor.

Xenia, O.— Aug. 2, 10 a. m. Macadamizing about four-fifths of a mile. Dayton and Xenia road. Certified check, $100. Walter L. Dean, auditor.

Coraopolis, Pa.—August 7, 7:30 p. m. Grading, paving and curbing various streets, aggregating about 11,500 sq. yds. E. C. Harper, borough secretary.

Newcastle, Pa.—July 31, 8 p. m. Repaving Long avenue, North street and Washington street. Certified checks with each bid. H. M. Marquis, city clerk.

Pittsburg, Pa.—Aug. 8, 10 a. m. Road improvements: Five contracts aggregating about 14.3 miles. Certified check with each bid. R. J. Cunningham, county controller.

Scranton, Pa.—Aug. 3, 11 a. m. Constructing county road, 2.7 miles. Certified check, 5 per cent. E. A. Jones, county controller.

Washington, Pa.—August 7, 12 m. Resurfacing the following roads with tarvia, warrenite, amiesite or other asphaltum material: One mile in the borough of McDonald; certified check, $1,200. One and one-half miles in Washington borough; certified check, $500. John E. Moffitt, county auditor; Chaney & Armstrong, county engineers.

Marysville, Tenn.—August 7, 12 m. Grading and macadamizing 85 miles of roads in Blount county. Certified check, 5 per cent. T. E. Cooper, chairman Blount county pike commissioners.

Brownsville, Tex.—Aug. 15, 12 m. Constructing about 27,500 sq. yds. paving; brick, creosoted wood block, or bitulithic. L. B. Puente, city clerk.

Colfax, Wash.—August 7, 2 p. m. Improving 5,600 feet of the Colfax and Palouse City road. Certified check, 10 per cent. S. M. McCroskey, county auditor.

Everett, Wash.—August 14, 2 p. m. Constructing State aid road. Certified check, 10 per cent. P. T. Lee, clerk.

Seattle, Wash.—August 1, 10 a. m. Grading, curbing, etc., on various streets. Certified check, 5 per cent. C. B. Bagley, secretary board of public works.

Stevenson, Wash.—August 10. Constructing county road near Prindle. A. Flieschhauer.

Tacoma, Wash.—Brick paving, etc., at the Cuchman Indian School. H. H. Johnson, superintendent Cuchman School.

Superior, Wis.—August 2, 1 p. m. Repaving and recurbing North Fourteenth street. Bids will be received on bitulithic, macadam, creosote block, asphalt and brick. Board of public works.

CONTRACTS AWARDED.

Little Rock, Ark.—Paving Washington street, to I. T. Shelby, Little Rock, Ark. Paving of creosoted wood blocks.

Los Angeles, Cal.—Constructing 6.01 miles of Foothill boulevard and Sierra Madre avenue, to O. O. Farmer, $40,787.92.

Pomona, Cal.—Grading and oiling streets, to Thos. E. Crawford, Pomona, Cal.

San Francisco, Cal.—Yard work of the Denman Grammar School, to Henning & Burke, $30,888.

East St. Louis, Ill.—The following paving contracts have been awarded: Gray blvd., to the St. Clair Engineering & Construction Company, $15,318; Eighteenth st., to the same. $11,610; Twenty-seventh st., to P. C. Gaylord, $14,908.

Springfield, Ill.—Paving Pasfield street, to the Capital City Concrete Construction Company, Springfield, Ill.

Bloomington, Ind.—Constructing brick pavement on Third st., to Blair & Kerr, $41,265.

Crown Point, Ind.—Road construction as follows: Pearson road, to the Ahlborn Construction Company, $19,050; the Schaaf road, to Lavenge Bros., $42,689; the Black road, to Downey & Portz, $18,897.

Fowler, Ind.—Constructing gravel roads: Erskine road, $3,300, and Gerlach road, $4,500, to Girmut Co., Muncie, Ind.

Greencastle, Ind.—The following road contracts have been awarded: The Arnold road, to Hurst & Sweet, $4,858; the Matthews road, to McGuire & Son, $4,458; the Crawley road, to James Mahoney, $2,225; the W. J. Smith road, to James Mahoney, $7,389; the Wright road, to J. M. Lisby, $8,750.

Jacksonville, Ind.—Paving Meridian street, to Ewing Shields, Seymour, Ind., $18,275.57.

Martinsville, Ind.—Constructing macadam road in Adams township, to E. A. Bourn, $9,082.

Peru, Ind.—Constructing sidewalks for new court house, to C. H. McCormack & Co., Columbus, Ind., $9,495.

Vincennes, Ind.—Road construction as follows: Wampler road, to Jesse Williams, $7,890; the Shultz road, to Ed Bolmer, $7,993; the Pol road, to W. E. Ruble, $7,260; the Royse road, to A. E. Cain, $3,690; Ashley road, to H. F. Jones, $11,750; the Barnes road, to Sam Taylor, $2,400; the Stitz road, to James McAndrew, $6,900.

Winchester, Ind.—Constructing Greenville pike, to Rutel & Griffith, $30,037.

Ames, Ia.—Paving five blocks of Grand avenue with creosoted blocks, to Wm. Horrabin, Iowa City, Ia.

Des Moines, Ia.—Paving Thirty-sixth street, sheet asphalt, to Mayer Bros. Paving Co., Des Moines.

Iowa City, Ia.—Paving contracts have been awarded to William Harrabin and B. J. Lambert, both of Iowa City.

Maquoketa, Ia.—Paving nineteen blocks, sixteen of which are to be of brick, to M. Ford, of Cedar Rapids, Ia.

Red Oak, Ia.—Paving 20 blocks with brick on various streets, to Hamilton & Schwartz, Shenandoah, Ia.; 5 blocks, to Maken Bros., Plattsmouth, Neb.; curbing and guttering, to Horton Bros., Red Oak, Ia.

Ft. Scott, Kan.—Paving contracts have

been awarded to the Midland Construction Co. and to Thogmartin & Gardiner.

Manhattan, Kan.—Paving Pointz avenue, sub-let by C. W. Cook & Son, to the Kaw Paving Company.

Louisville, Ky.—Road contracts aggregating $32,000 have been awarded as follows: Edenside avenue, 1,400 ft., to the American Standard Asphalt Company; Harp avenue, 1,250 ft., to the Barber Asphalt Paving Company; Sill street, one block, to the Louisville Asphalt Co.

Boston, Mass.—Constructing 7,300 ft. of state highway, to Porchia Bros. Construction Company, $7,192.

Boston, Mass.—The following paving contracts have been awarded: Macadam roadway on Railroad street, to the West Roxbury Trap Rock Co., $4,162; brick pavement on Hancock street, to S. F. & A. P. Gore Corporation, $17,909; constructing curb and gutter on Milton avenue, to C. W. Dolloff Co., $1,634; gutters and sidewalks on Welds Hill, to James Doherty, $3,474.

Boston, Mass.—The following paving contracts have been awarded: Paving Fleet st. with granite block, to McGuire & Kiernan, $6,435; paving Roxburg st. with granite block, to Chas. S. Jacobs & Company, $2,240; constructing gutters in Hall st., to James Doherty, $1,544; paving North st. with granite block, to John F. O'Connell, $12,365.

Holyoke, Mass.—Paving Railroad, Essex and Jackson sts., with vitrified brick, to the Shawmut Brick Works, 141 Milk st., Boston, Mass.

Duluth, Minn.—Improving West End streets, to Hugo Steele, $41,141.

Hibbing, Minn.—Constructing the Iron Junction road, to Chris Daley, $4,180.

St. Paul, Minn.—Grading Grantham street, to Keough Bros., $2,592.

St. Joseph, Mo.—Paving contracts to Young Bros. Construction Co., and Land Bros.

Hastings, Neb.—Constructing Seventh st. paving, to M. Ford, Omaha, Neb.

Dunkirk, N. Y.—Paving contracts have been awarded to J. & M. Doyle and John McCormick & Son, both of Erie, Pa.

Little Falls, N. Y.—Paving Albany and Second streets, to the Warren Bros. Co., of Boston, Mass., $27,081.

Rochester, N. Y.—The following paving contracts have been awarded: Park avenue, asphalt pavement, to Whitmore, Rauber and Dicimus, $26,120; Gardiner avenue, asphalt pavement, to the Rochester Vulcanite Pavement Co., $15,613; Copeland street, brick pavement, to Clarence Aikenhead, $6,033; Pinnacle road, brick pavement, to F. G. Brotsth, $7858; Magee avenue, cement walks, to W. A. Macgrander, $893; Mohawk street, grading and constructing sidewalks, to J. Friedrich Co., $619.

Seneca Falls, N. Y.—Constructing West Falls st. pavement, to the Kennedy Construction Company, Albany, N. Y., $12,573.

Utica, N. Y.—Repaving Oneida street with bitulithic, to Warren Bros. Co., $11,820.

Athens, O.—The following paving contracts have been awarded: Elliott street and West State street, to Mill & Coss, $8,000; May avenue, to W. F. Bower, $5,-764; West State street, second section, to W. R. Wilson, $2,173.

Canton, O.—Paving Logan avenue and Shorb street, to Logan B. Burg, $11520 and $19,841, respectively; Paving Virginia avenue, to Press Campbell, $15,429; paving East Eighth street, to Turnbull & Sons, $26,574; paving Block and Arch street, to Peter Christensen, $3,084.

Cincinnati, O.—Road improvement, as follows: Sharon avenue, to J. P. Hunley, $10,-349; Springfield road, to H. E. Steele, $11,-712; Indian Hill avenue, to F. E. Schroeder, $9,740.

Columbus, O.—The following paving contracts have been awarded: Sixteenth ave., to M. J. Burns, $8,787; Seventeenth ave., to George W. Patterson & Sons, $10,030; Eldridge ave., to S. T. Knight, $10,006; Donaldson st., to Geigle, Garnes & Co.; Harris st., to W. M. Graham, $5,108; Hildreth ave., to A. G. Pugh, $13,084; Hughes st., to same, $2,758; McCoy st., to Geigle, Garnes & Co., $3,084.

Dayton, Ohio.—Street improvements, to Warren Bros. Paving Co., $2,176.20 for Liberty street, and $1,593.65 for DeKalb street.

East Liverpool, O.—Paving Fifth street, to George B. Patterson, $2,206.

Elyria, O.—Paving Broad st., to the Ohio Engineering Co., Elyria, O., $9,600.

Fremont, O.—Paving Lynn st., to Modern Construction Company, of Fremont, $9,922.

Geneva, O.—Paving Main street, to E. A. Freshwater & Son.

Hamilton, O.—Paving Charles street with sheet asphalt, to the Andrews Asphalt Paving Co.

Kent, O.—Paving Main street, to the Ohio Engineering Company, of Elyria, O., $28,480.

Lorain, O.—The following paving contracts have been awarded to the Ohio Engineering Company, of Elyria, O.: East Erie avenue, with brick, $31,720; Hamilton avenue, with brick, $7,345; alley west of Broadway, with brick, $4,151.

Mansfield, O.—Paving South street, West Liberty street and Mansfield road, to Her-

Marion, O.—The following paving contracts have been awarded: Marion Prospect road, to J. B. Gillespie, $6,162; constructing Tarvia road, to the Continental Bitumen Co., of Waldo, O., $5,345; resurfacing Marion Upper Sandusky road, $4.-052, tar work on same to the Continental Bitumen Company, $3,424.

Middletown, O.—Constructing asphalt pavement on Baltimore street, to the Andrews Asphalt Paving Co., of Hamilton, O., about $28,000.

Mt. Gilead, O.—Stone curbing, to Raymond & Caldwell, $2.450.50.

New Boston, O.—Grading the Harrisonville pike, to Asa Canter.

New Lexington, O.—Paving two sections of Main street, to George J. Bock & Son, of Coshocton, O., $12,500.

Pomeroy, O.—Paving Front street, to Geo. Bauer, Pomeroy; paving Kerrs Run, to J. E. Lindsey, of Middleport, Ohio.

Salem, O.—Paving ½ mile of road, to Morris & Morgan, Girard, O., $6,600.

Springfield, O.—Constructing macadamized road on Hillside avenue, to W. F. Payne, $3,482.

Toledo, O.—The following sidewalk contracts have been let: The Eddis Stone Co., $20,858; James H. Horan, $11,768; W. W. Hummell, $10,807; H. W. Wells, $5,636; paving Kelsey avenue, to John McMahon, $2,031.

Youngstown, O.—Grading Erie street, to Ed Kane, $3,485; paving Cleveland street, to Miller Bros., $9,811.

Youngstown, O.—The following road contracts have been awarded: Poland-New Middletown road, two miles, to Galdini and Mage; Poland-Center road, two miles, to Chambers and Halley; Lowellville and Hillsdale road, to J. W. Gay & Son. All roads to be macadamized.

Youngstown, O.—Paving Myrtle ave., to Kennedy Bros., $39.865.

Oklahoma City, Okla.—Paving Olie street with asphalt, to Cleveland Trinidad Paving Company, $28,278; Harvey avenue, to the Weston Paving Company, $29,322.

Portland, Ore.—Paving Milwaukie street with Hassam pavement, to the Consolidated Contract Company, $128,319.

Butler, Pa.—Paving American avenue with Butler and DuBois block, to Tony Morelli.

Erie, Pa.—Paving as follows: Fifth

street, to Mayer Bros, for Bermuda asphalt; Cascade street, to McCormick & Son; Liberty street, to Mayer Bros.

Greensburgh, Pa.—Road construction as follows: To McCardy Bros. & Co., Braddock, $71,248; to B. H. Cunningham & Son, Turtle Creek, $45,217; to P. J. Keck, Homestead, $73,762.

Harrisburg, Pa.—Paving four streets, to the Barbar Asphalt Paving Co.; paving eleven streets, to The Central Construction & Supply Co.

Indiana, Pa.—Paving Seventh street, to M. Bennett & Son.

Mt. Pleasant, Pa.—Constructing roads, to McCrady Bros. & Co., Braddock,, $71,248; H. B. Cunningham & Son, Turtle Creek, $45,217, and P. J. Keck, Homestead, $73,762.

Newcastle, Pa.—The following paving contracts have been awarded: N. Mercer st., to Kimbrough & Elder, $5,243; Winter ave., to the Newcastle Contracting Company, $6,765.

Philadelphia, Pa.—Repairs, resurfacing and paving, to the Barber Asphalt Paving Company, about $500,000; constructing vitrified brick and granite block, to the Mack Paving & Construction Company.

Philadelphia, Pa.—Resurfacing York road, about two miles, with Filbertine, to the Filbert Paving Co., $30,000.

Pittsburg, Pa.—The following paving contracts have been awarded: Cement walk in Riverview Park, to Pittsburg Sanitary Flooring Co., $2,130; sidewalk in Arsenal Park, to M. Welsh & Co., $2,063.

Pittsburg, Pa.—Constructing Guyasuta road, to Dallas and Nargulli, $7,712.

Reading, Pa.—Macadamizing nine blocks of street, to John Weigner, $10,750.

St. Clair, Pa.—Paving Clover street, to A. G. Neeld, Jr., $7,488.

Scranton, Pa.—The following paving contracts have been awarded: Pine street and Washington street with stone block, to Blewitt Paving & Construction Co.; Wyoming avenue and Green Ridge, to the MacDonald Construction Co.; Sunset avenue, Vermont street and Kressler Court, to same.

Sharon, Pa.—Paving West State street with Tarvia with slag base, to William McIntyre & Sons.

Union City, Pa.—Building concrete culvert and two breakwaters, to Thomas McDannell.

Washington, Pa.—Constructing 22 miles of brick-paved highway, aggregating $348,259.95, to F. J. Erbeck, of Homestead; Collins-Gordon Co., of Pittsburg; Samuel Gamble, of Carnegie; Hastings & Piper, of Charleroi; Reed & Liggett, of Washington, and William Pickett & Co., of Washington.

Memphis, Tenn.—Paving Union ave., to R. C. Huston, $17,200.

Dallas, Tex.—Paving Cole avenue, to J. A. Gregory, $32,260.

Colfax, Wash.—Constructing bitulithic pavement, to the Warren Construction Company, $76,111.

North Yakima. Wash.—Constructing walks, curbs, etc., to Wilson & Hardy, $24,146.

Seattle, Wash.—Constructing sidewalks on Thirty-second avenue, to Allain & Hull, Seattle, $4,382.25; sidewalks on Weller street, to Smith Contracting Co., Seattle, $4,458.40, and paving Twenty-first avenue, North, to Barber Asphalt Co., $122,835.85.

Seattle, Wash.—Paving, grading, etc., to Barber Asphalt Co., $19,400; to Andrew Peterson & Co., $37,589; constructing concrete walks, to DeFlong & Co., $1,135; grading and curbing, to Macquaid & Moore; constructing walks, to Krogh & Jesson, $8,327.

Seattle, Wash.—The following street improvement contracts have been awarded: Alley in Block 2, to MacQuaid & Moore, 472 Arcade building, $730; sidewalk on East Fiftieth street, to Krogh & Jessen, 1418 Twenty-fourth avenue, $8,327.

Seattle, Wash.—The following paving contracts have been awarded: Belvidere avenue, to L. C. Lane, Hinckley block, Seattle, $52,586; grading alley in block 2, to Macquait and Moore, 472 Arcade building, Seattle, Wash., $730; constructing concrete walk on Market street, to the Smith Constructing Co., Empire building, Seattle, $3,591.

Spokane, Wash.—Grading etc., to Naylor & Norlin Co., two contracts, $6889 and $19,979, respectively; Massie Bros & Long, two contracts, $9,476 and $5,177, respectively; to J. C. Kennedy, $1,950; and sidewalk, to Abbott & Joslin, $634.

Spokane, Wash.—The following grading and sidewalk contracts have been awarded: To Massie & Lang, 612 Buckeye ave., $16,288; Euclid ave., $4,035; Lidgerwood st., $20,949; Jefferson st., $8,039; Mission ave., $26,630. To J. P. Kennedy, 1418 Riverside ave., Twenty-third ave., $7,228. To C. N. Payne, 2724 Mission ave., Gordon ave., $10,130; Crown ave, $6,720; Pittsburg st., $4,445. To Abbott & Joslin, P. O. Box 513, structing water works system as noted in Conklin st., $3,959; Wall st., $6,700. To Penn Paving & Construction Co., Rockwood blvd., $3,540; Arthur st., $12,000; Highland blvd., Rockwood blvd. and Garfield road, $51,000. Paving with Hassam concrete, to the Inland Empire Hassam Paving Company, 322 Lindell block, Washington st., $29,280. Paving with asphalt, to J. S. Hill, 601 Jamieson block, Howard st., $18,970.

Clarksburg, W. Va.—Paving the Northwestern turnpike, to Allen & Horner, Clarksburg, W. Va.

Wheeling, W. Va.—Paving Ellet street, to Pickett & Shannafelt.

Milwaukee, Wis.—Paving construction, to Badger Construction Co., of Milwaukee, and R. F. Conway Co., of Chicago.

Rhinelander, Wis.—Improving streets, to McGrath Construction Co., Green Bay, Wis., $13,625.

Vancouver, B. C.—Improving Twenty-sixth street with Tarvia, to Rector & Daly, $21,995; improving Harney street, to S. P. White, $6,991.

CONTEMPLATED WORK.

Los Angeles, Cal.—The board of public works has authorized the purchase of 11,000 barrels of crude oil for use on the roads.

Pasadena, Cal.—The city is contemplating the construction of oil macadam roadways on five streets to cost about $300,000.

St. Petersburg, Fla.—A $35,000 bond issue for the construction of brick paving has been voted.

Tampa, Fla.—The city is contemplating the paving of Zack street, to cost about $7,000.

Danville, Ill.—Ordinances passed for the construction of sidewalks on North, Chandler and Vermilion streets.

East Moline, Ill.—The city is contemplating the paving of State street with brick, to cost about $53,000.

Boston, Mass.—The city is contemplating the re-paving of Tremont st., to cost about $50,000.

Hibbing, Minn.—The city council has ordered the construction of cement sidewalks on several streets.

Litchfield, Minn.—Cement sidewalks have been ordered in on several streets. John Rodange, village recorder.

Lucerne, Minn.—The city council has authorized the construction of sewers.

Pipestone, Minn.—Cement sidewalks have been ordered in on several streets. S. W. Funk, city recorder.

St. Paul, Minn.—The city is contemplating the paving of Summitt ave., to cost about $80,000.

Belton, Mo.—A $10,000 bond issue for macadamizing of different streets has been voted.

St. Joseph, Mo.—The city council has passed an ordinance for paving in Seventeenth street with Bermudez asphalt macadam.

Buffalo, N. Y.—The city is contemplating the paving of Main street. Frances G. Ward, commissioner of public works.

Lancaster, N. Y.—The city is contemplating the paving of Central ave., to cost about $43,000.

Seneca Falls, N. Y.—An $81,000 bond issue for street improvements has been voted.

Charlotte, N. C.—Bonds have been voted for the construction of street improvements, water works and sewers.

Max, N. D.—Cement sidewalks have been ordered in on several streets. Theo. W. Kemps, village clerk.

Canton, O.—The paving of the Canton-New Berlin road, to cost about $38,000, is contemplated.

Cincinnati, O.—The city council has ordered the paving of Delaney street. Edwin Henderson, clerk.

Hamilton, O.—A survey for two miles of macadamized roads, to cost $14,000, has been completed. L. A. Dillon, county surveyor.

Mansfield, O.—The city council has authorized grading and laying sidewalks in Buckley and Western avenues. Director of public service.

Mineral City, O.—The county has ordered construction work on the Jefferson township and Newport pikes.

New Philadelphia, O.—Aug. 7, 1 p. m. Piking two roads. Certified check, $50. W. C. Shott, county auditor.

Youngstown, O.—The city council has ordered the grading of Essex, Burke and Garland streets, and the paving of Central avenue.

Beaver, Pa.—A $20,000 bond issue for street improvement has been voted.

Carnegie, Pa.—The council has voted to pave Highland avenue and Homestead with brick. H. R. Bigham, borough clerk.

Mt. Pleasant, Pa.—The town council has voted to grade, curb and pave North Shupe street. M. A. King, secretary of council.

Pittsburg, Pa.—The city has authorized the construction of a relief sewer in the Negley Run drainage basin; also sewers in Bates and Russell streets.

Reading, Pa.—The city has ordered paving in Court and Seward streets.

Sebring, O.—The city council has authorized the paving of Ohio avenue. Harry Jenkins, clerk.

Sharpsburg, Pa.—Grading Butler street has been authorized.

Milwaukee, Wis.—The constructing of a boulevard along the Janesville plank road is contemplated.

SEWERS.

BIDS REQUESTED.

Prescott, Ark.—August 9, 4 p. m. Furnishing materials for the construction of sanitary sewers, to cost about $40,000. J. W. Beebe, Poteau, Okla., engineer.

Washington, D. C.—The American consul general at Vancouver, B. C., reports that bids are wanted for sewer pipe, about ten miles. Bureau of Manufactures, No. 7010.

Americus, Ga.—August 1, 7 p. m. Constructing sewers and appurtenances, about 12 miles. T. N. Hawkes, city clerk.

Thomaston, Ga.—August 23, 2 p. m. Constructing sewer and water works. Certified check, 5 per cent. R. E. Rushin, city clerk.

Ligonier, Ind.—Aug. 10, 2 p. m. Constructing sewage plant and sewage purification plant, as noted in Bulletin of July 1. Ira F. Brant, secretary. F. S. Shaw, Reading, Pa., engineer.

Pella, Ia.—August 2. Constructing 15,000 feet of sewer. A. C. Kuypper, city clerk.

Frankfort, Ky.—August 1, 12 m. Constructing septic tank and filter bed at the Kentucky Houses of Reform, Greendale, Ky. Certified check, $500. Eli H. Brown, Jr., chairman of prison commissioners.

New Orleans, La.—September 11, 12 m. Sewers and drainage work. Geo. G. Earl, general superintendent; S. S. Shield, secretary.

Boston, Mass.—August 1, 12 m. Constructing sewerage works in Market street and in Perthshire road, Brighton.

Neligh, Neb.—Aug. 5, 1 p. m. Constructing sanitary sewers, to cost about $10,000. Certified check, $500. O. S. Hauser, city clerk.

West Orange, N. J.—August 1. Constructing sewers in Kirk street. Certified check, $100. Joseph McDonough, town clerk.

Cincinnati, O.—August 1, 12 m. Constructing main and lateral sewers, with appurtenances, in ravine between Reading road and Ridgeway avenue. Certified check. John J. Wenner, clerk director of public service.

Girard, O.—Constructing storm water sewer in Liberty street. Certified check, $500. James E. Stotler, village clerk.

Nottingham, O.—August 4, 12 m. Constructing sewers in Forest avenue, Sunset drive and Park road. Certified check, $100, with each bid. J. C. Steinicke, clerk.

Toledo, O.—August 3, 12 m. Constructing local sewer No. 1118. Certified check. Fred Shane, secretary director of public service.

Crafton, Pa.—August 1, 4 p. m. Constructing various sewers. Certified check, $250. McBride Surveying and Engineering Co., Ltd., Pittsburg, borough engineers.

Lebanon, Pa.—August 10, 5 p. m. Constructing 6,400 lineal feet of 30-inch outfall sewer and disposal plant. Certified check, 5 per cent. About 29,000 lineal feet of vitrified-pipe sewers, from 6-inch to 18-inch diameter; about 700 feet of 18-inch cast iron pipe, and 2,200 feet of 24-inch reinforced concrete pipe, with manholes, flush tanks and other appurtenances. Certified check, $2,500. E. R. Crowell, city engineer.

Nashville, Tenn.—August 10, 3 p. m. Building about seven miles of brick trunk sewers. Certified checks. Wm. W. Southgate, city engineer.

Huntington, W. Va.—Aug. 7, 1 p. m. Constructing vitrified tile sewers. John Coon, commissioner of streets. A. B. Manpin, city engineer.

CONTRACTS AWARDED.

Mobile, Ala.—Constructing wooden storm sewer, to C. A. Chamblin, $3,564.

Dixon, Cal.—Constructing sewer and disposal plant, to Brady & Fisher, San Francisco, $23,985.

Oakland, Cal.—The following sewer contracts have been awarded: District No. 1, to Chambers & Heafy, $79,132; District No. 2, to Contra Costa Construction Co., $77,877; District No. 3, to C. B. Vincent, $102,126; District No. 4, to C. B. Vincent, $110,625.

San Francisco, Cal.—Constructing sewers in section G, of the north point main, to John Daniel.

San Francisco, Cal.—Constructing Section D-2, North Point main sewer, to Healy-Tibbits Construction Co.

Denver, Colo.—Constructing storm sewers, to the Gaffy & Keefe Construction Co., $8,140; Denver-Pueblo Construction Co., $13,181.04.

Michigan City, Ind.—Constructing sewer on Michigan street, to Peter Michaely-. Michigan City.

Valley Junction, Ia.—Constructing city sewers, to Geo. M. King Construction Co., Des Moines, Ia., $15,159.30; constructing outlet and disposal plant, to Geo. A. Mallory & Co., Kewanee, Ill., $12,329.

Waterloo, Ia.—Constructing 6,080 ft. of 10 to 30-inch sewer, to the Blackhawk Construction Co., Waterloo, Ia.

Waterloo, Ia.—The following sewer contracts have been awarded; $3,020 ft. sanitary sewer, to the Dearborn Jackson Construction Company, of Cedar Rapids, Ia., $1,685; 1,240 lineal ft. storm sewer, to M. A. Panery, of Harlan, Ia., $1,554.

Boston, Mass.—Constructing pipe sewers, to Timothy Coughlin, $526.

Bay City, Mich.—Constructing 30-inch concrete pipe, to P. Ryan & Son.

Detroit, Mich.—Constructing Fairview sewer, to John Gindel, 404 Buhl bldg., $32,700.

Duluth, Minn.—Constructing storm sewer in Forty-first avenue, to J. A. Johnson, $6,336.

Fairmont, Minn.—Constructing 12,000 ft. of sewers, to J. W. Turner Construction Company, Des Moines, Ia., $9,780.

St. Paul, Minn.—Sewer extension on Richmond street, to E. T. Webster, $928.

St. Joseph, Mo.—Sewer construction, to E. F. Mignery.

Whitefish, Mont.—Constructing sewers, to Sam Odergard, Kalispell, Mont., $13,500; septic tanks, to W. A. Powers, Kalispell, Mont.

Paterson, N. J.—Constructing Section A of the West Paterson and Totowa sewer, to McKiernan & Bergin, $28,304.75.

Buffalo, N. Y.—Constructing 12 to 36-inch tile sewer in Connelly street, Olympic, Warwick and Northumberland avenues, to W. C. Pulliton, $16,793.

Kent, O.—Constructing sewer in East Main street, to Norman & Son, Kent, O.

Lafayette, O.—Sewer construction, to Scanlon & Trainor, Huntington, W. Va.

Lancaster, O.—Constructing sewer in West Sixth avenue, to Clover & Sheets, $2,867.59.

Mansfield, O.—The following sewer contracts have been awarded: Storm water sewer on W. Third st., to Lyman Ostrander; sanitary sewer on Elmwood Drive, to George C. Long.

Niles, O.—Constructing sewer in Chester st., No. 1, to F. Manelli, Pittsburg, Pa.

Portsmouth, O.—Constructing sanitary sewers, to John A. Grimes, $541 and $726.

Springfield, O.—The following sewer contracts have been awarded: Cedar street, to Daniel Doyle, $5,591; Thompson avenue, to M. J. Cooney, $419; Water street, to same, $547; Innessallen avenue, to same, $468.

Toledo, O.—The following sewer contracts have been awarded: To A. Greybowski, $3,337 and $330; to H. G. Frobase, $896.

Chandler, Okla.—Constructing sewers, to Van Meter & Co., Oklahoma City, $16,600.

Shawnee, Okla.—Sewer construction, to the Western Paving Company, of Oklahoma City, Okla., $18,261.

Fillsboro, Ore.—The following sewer contracts have been awarded: Sanitary sewers, to Mason & Combs, Portland, Ore., $35,340; storm sewers, to the Kennedy Construction Company, $28,273.

Oregon City, Ore.—Constructing sewer, to Harry Jones, $7,200.

Connellsville, Pa.—The construction of a complete sewerage system and sewage disposal plant is contemplated. A. B. Hogg, engineer.

Eddystone, Pa.—Constructing sewers, to the Cantrell Construction Company, Philadelphia, Pa., $8,950.

Erie, Pa.—Constructing 9-inch sewer in Thirteenth street, to Edward Driscoll.

Newcastle, Pa.—The following sewer contracts have been awarded: Sanitary sewer on McCreary ave., to Kimbrough & Elder; sanitary sewer on S. Mill st., to Frank M. Mayberry & Son.

West Chester, Pa.—Constructing main outfall sewer, to the Corcoran Construction Company, West Chester, Pa., $11,000; constructing disposal plant, to the Farrell Company, West Chester, $46,000.

Wilkinsburg, Pa.—July 16, 4 p. m. Constructing 10 and 20-inch pipe sewers on Penn ave.; 8-inch sewer on Wright ave., to Frease & Sperling, engineers.

Madison, S. D.—Constructing sewer system, to L. M. Meeker and Arthur Dobson, Lincoln, Neb., about $30,000.

Nashville, Tenn.—Constructing sewer on the Jo Johnston ave. sewer, to F. C. Daniels.

Olympia, Wash.—Constructing trunk sewer, to James Mitchell, $4,339.

Seattle, Wash.—Constructing sewers, to Johnson & Co., $44,067.

Spokane, Wash.—Constructing various sewers, to P. L. Langen, $38,979, and to J. C. Broad, $4,165.

Seattle, Wash.—The following sewer contracts have been awarded to Krogh & Jessen, North Fifty-ninth street: Two sections, at $46,515 and $13,381.

South Bend, Wash.—Constructing trunk sewer, to the Jahn Contracting Company, Empire bldg., Seattle, Wash., $26,085.

Chippewa Falls, Wis.—Constructing sewers, to Frazer & Danforth, St. Paul, Minn., $5,201.

Janesville, Wis.—Constructing sewers in N. Main st., to Tibbey Bros., Dubuque, Ia., $11,925.

Superior, Wis.—Constructing sewer in Lamborn avenue, to John Anderson, $3,410.

Cranbrook, B. C.—Constructing a water supply system, to Galt Engineering Works, $100,000.

Winnipeg, Man.—Constructing sewers as follows: Trunk sewer and Mission street sewer, to Van Hornbeck Co., $63,403 and $26,731.53, respectively; Montcalm street sewer, to Hern & Knox, $1,953; various other sewers, to Felix Cottonier, aggregating $8,178.15.

CONTEMPLATED WORK.

Little Rock, Ark.—A committee has been appointed to make plans for the construction of storm sewers. Chas. E. Taylor, mayor.

Los Angeles, Cal.—The board of public works contemplates constructing sewers for Hollywood and the northwestern part of the city, to cost about $500,000.

Pacific Grove, Cal.—The construction of a $62,000 sewer system is contemplated. T. B. Hunter, Monterey, Cal., engineer.

San Francisco, Cal.—The board of public works has been authorized to construct sewers in Glen Park extension, $25,000, and North Point main sewer, $85,000, and various other sections. W. R. Hagerty, clerk board of supervisors.

Washington, D. C.—Consul-General Sammons, of Yokohama, Japan, reports that the authorities of Tokio have decided to install a complete sewerage system to cost between $17,000,000 and $20,000,000. Holders of American patents on sewer pipe should have the same registered in Japan. Address inquiries to Bureau of Manufacturers, No. 6934.

Bloomington, Ill.—Construction of the Clayton street sewer has been authorized.

Danville, Ill.—Ordinances passed for sanitary sewers in the alleys between Douglas avenue and Wayne street, and in the alley between Douglas and McReynolds avenues.

Rockford, Ill.—The city engineer has prepared plans for a sanitary sewer to cost about $36,700.

Columbus, Ind.—The city is contemplating the construction of a complete sewer system.

Cedar Rapids, Ia.—A $55,000 bond issue for sewer construction has been voted. L. J. Story, city clerk.

Logan, Ia.—The city is contemplating the construction of sewers to cost about $22,500. Bruce & Spandezen, Bee bldg., Omaha, Neb., engineers.

Lake Charles, La.—A sewerage system to cost $160,000 is contemplated.

St. Joseph, Mo.—Ordinances passed for construction of sewers for Chestnut, Atchison and Helena streets, and in McCool's addition.

Butte, Mont.—The city is contemplating the construction of sanitary sewers. Paul A. Gow, engineer.

Lincoln, Nebr.—The city is contemplating the construction of sewers to cost about $40,000.

Montclair, N. J.—The county engineer has been authorized to ask for bids for 500 ft. of storm sewers in Bloomfield avenue.

Paterson, N. J.—The board of public works has authorized the construction of six sections of the West Paterson and Totowa sewer.

Binghamton, N. Y.—The city council has ordered the construction of sewers in Pennsylvania and Vestal avenues.

Matteawan, N. Y.—A $60,000 bond issue for water works and sewer improvements has been voted.

Charlotte, N. C.—Bonds have been voted for the construction of sewers, water works and street improvements.

Akron, O.—The city council has authorized the construction of sewers in Jewett street. Dow W. Harter, clerk of council.

Cincinnati, O.—The city council has ordered the construction of 12-inch, 15-inch and 18-inch vitrified pipe sewers in Waverly avenue and Blaine road. Edwin Henderson, clerk.

Cleveland, O.—The city council has authorized construction work on the Ontario street and Warren road sewers. Director of public service.

Columbus, O.—The construction of a sewer known as the Milo main trunk sewer, to cost $50,000, is contemplated. Leroy H. Rose, acting clerk.

Hamilton, O.—The council has authorized sewer work in Ludlow, Sycamore and Seventh streets. Director of public service.

Lorain, O.—The council has authorized the construction of sewers. Director of public service.

Mansfield, O.—The city council has authorized the construction of various sewers. Director of public works.

Youngstown, O.—The city council has ordered the construction of a sewer in Bernard street.

Chickasha, Okla.—A $25,000 bond issue for the purpose of reclaiming 2,000 overflow land has been voted by the city.

Oklahoma City, Okla.—The commissioners have voted to establish four new sewer districts.

Oklahoma City, Okla.—The city commissioners are inspecting septic tanks and contact beds with a view to the installation of a sewage disposal system in Oklahoma City.

Shawnee, Okla.—The city is contemplating the construction of five miles of sewer, the contract for which will be let soon. Frank D. Brown, city engineer.

Eugene, Ore.—The city council has ordered the construction of sewers to cost $12,000.

Hood River, Ore.—The city is contemplating the construction of about 15,000 ft. of sanitary sewers.

Springfield, Ore.—The city council has ordered the construction of three main sewers, about $12,000.

Altoona, Pa.—The city will engage Hering & Fuller, of New York, to complete plans for construction of main sewers in the eastern district.

Canonsburg, Pa.—The town council has voted to construct certain sewers. W. C. Black, secretary of the council.

Grove City, Pa.—The council has voted to construct a sanitary sewer in Barmore avenue and Stewart street. L. L. McKay, borough clerk.

McKees Rocks, Pa.—The commissioners have authorized the construction of sewers.

Scranton, Pa.—The city is contemplating construction of sewers on various streets. P. C. Jordan, president of council.

Washington, Pa.—The town council has authorized the construction of 1,180 feet of sanitary sewer. J. F. Curran, president of council.

Wilkinsburg, Pa.—The borough council has authorized the construction of a sewer or culvert to inclose Nine Mile run. Borough engineers.

Dallas, Tex.—The city contemplates building sewers and water works.

Rocky Mount, Va.—The city has voted $50,000 for construction of water works, electric light plant and sewer system.

Shelton, Wash.—A $15,000 bond issue for sewer construction has been awarded.

Tacoma, Wash.—The city is contemplating the construction of sanitary sewers on S. Thirty-fourth and other streets to cost about $23,000. Owen Woods, commissioner of public works.

WATER WORKS.

BIDS REQUESTED.

Monte Vista, Colo.—August 15. Erecting steel water tank and tower at the Soldiers' and Sailors' Home. O. S. Storrs, president.

Thomaston, Ga.—August 23, 2 p. m. Constructing water works and sewers. Certified check, 5 per cent. R. E. Rushin, city clerk.

Cicero, Ill.—Laying water supply pipe, about $5,300. Chas. Stoeffel, clerk board of local improvements.

Brazil, Ind.—August 8, 11:30 a. m. Constructing complete water works and electric light plant. J. D. Walpole, recorder.

Alice, Minn.—August 2, 8 p. m. Constructing village well, water mains and steel water tank. A. E. Dyer, village engineer, Hibbing, Minn.; Oscar Wirstrand, village clerk.

Preston, Minn.—August 7, 8 p. m. Laying 2-inch water pipe. W. Kruppenbacher, village recorder.

Anselmo, Neb.—August 8, 8 p. m. Constructing a complete water-works system. Certified check 5 per cent. E. E. Philpott, village clerk.

Bottineau, N. D.—July 31, 8 p. m. Constructing a shallow well with wood, brick or concrete curbing. Certified check 5 per cent. D. R. Carlson, city auditor.

Athens, O.—August 10, 12 m. Furnishing air compressor, air receiver, reservoir and pipe connections for five air lift wells at the Athens State Hospital. Dr. O. O. Fordyce, secretary board of trustees; Osborn Engineering Co., engineers, 20 E. Broad st., Columbus, O.

Pittsburg, Pa.—August 4, 10 a. m. Furnishing coal and ash-handling apparatus for the Aspinwall pumping station. Bond, $9,000. Jos. G. Armstrong, director of public works.

Pittsburg, Pa.—August 4, 10 a. m. Furnishing two water tube boilers, two mechanical stokers, flue and appurtenances for Ross pumping station. Bond, $8,500. Jos. A. Armstrong, director of public works.

Ft. Worth, Tex.—Sept. 5. Constructing a dam containing about 300,000 cu. yds. of earthwork and 60,000 cu. yds. of masonry; also 6½ miles of concrete pipe. Board of engineers.

CONTRACTS AWARDED.

Russellville, Ala.—Constructing water works and light plant, to W. W. Moore, Birmingham, Ala.

Auburn, Ga.—A $20,000 bond issue for installation of water works and sewer systems has been voted. J. B. McCreary, Atlanta, Ga., engineer.

Gilmore City, Ia.—Constructing a water works plant, to C. W. Roland Co., Des Moines, Ia., $13,595.

Emporia, Kan.—Constructing water works system, to Builders Material Supply Company, Scarritt bldg., Kansas City, $9,097.

Boston, Mass.—The following water contracts have been awarded: Relaying pipe on Brighton street, to S. Bambia, $10,119; laying water main on Intervale street, to Hugh McNulty, $1,140; relaying water pipe on Church, to J. A. Costello & Co., $1,175; furnishing 1,500 concrete meter boxes, to Eagar & McNamee, at $4.10 each.

Ada, Minn.—Digging 10-inch artesian well, to Swenson Artesian Well Co., Minneapolis, Minn.

Ellsworth, Minn.—Constructing 50,000-gallon reservoir, to C. N. Gilhan, Luverne, Minn.

Eveleth, Minn.—Supplying 36 tons of 7-inch cast iron pipe and three valve boxes, to Jas. B. Clow & Sons, Minneapolis, Minn.

Fairmont, Minn.—Constructing seventeen blocks of water mains, to the J. W. Turner Construction Company, Des Moines, Ia., $5,850.

Mankato, Minn.—Installing the East Mankato auxiliary water plant, including 50,000-gallon steel tank, 110-foot steel tower, pipe lines, pump house, pump and motor, to J. G. Robertson, St. Paul, $6,850.

Chadron, Neb.—Furnishing wood pipe for water works system, to the Portland Pipe Co., $17,000; constructing the dam and laying the pipe, to the Inter-Mountain Bridge and Construction Co., $8,232.

Crosswick, N. J.—Constructing water works for the Crosswick Water Company, to cost $13,500, to Thomas J. McGovern, of Trenton, N. J.

Buffalo, N. Y.—Constructing water works intake pier, to Chas. H. Everitt, 424 White building, Buffalo, $43,490.

New York, N. Y.—Constructing Hudson river division of Catskill equeduct, to T. A. Gillespie Co., Pittsburg, Pa., $1,649,020.

Tarboro, N. C.—Construction works improvements, to the Edwards Construction Company, of Tarboro, N. C.

Lucasville, O.—The village is contemplating the installation of a water works system. Address Alonzo Purdy, or W. E. Purdy.

Altus, Okla.—Drilling 2,500-foot well for artesian water supply, to Kerwin Drilling Co., Petrolia, Tex.

Dewey, Okla.—Constructing water works system, to F. R. Stone, $36,350.

Oklahoma City, Okla.—Constructing concrete dam at the water plant, to Reinhart & Donovan, Oklahoma City, Okla., $9,339.

Baker, Ore.—Constructing 8¾ miles of concrete pipe line, to the Idaho Glazed Cement Pipe Co., $90,000.

Toledo, Ore.—Constructing water system, 6 miles of pipe, to Jacobson-Bade Co., Portland, Ore., $20,000.

Bristol, Pa.—The borough council has authorized the purchase of the Bristol Water Co.'s plant, $112,640.

Falls Creek, Pa.—Constructing water works system, to Minns Bros., Du Bois.

Austin, Tex.—A contract has been let for the construction of a dam and hydraulic plant, to William D. Johnson, Hartford, Conn., $1,000,000, subject to ratification by a referendum vote.

Dallas, Tex.—Constructing three Woodbine wells, to Sharp & Co.; constructing two wells, to Fausett & Hall, of Corsicana, Tex.

Seattle, Wash.—Supplying lock bar pipe on Cedar river water supply system, to E. W. Cummings and C. H. Kiehl, at $172,817.

Seattle, Wash.—The following contracts for water construction have been awarded: Laying water mains on West Sixtieth street, to Church & Erickson, 126 Twentieth avenue, Seattle, Wash., $13,307; constructing penstock, to J. L. Richie, of 1233 Eighteenth avenue, about $30,000.

LaCrosse, Wis.—Construction of water works extension, to Thos. P. Wooley, LaCrosse, Wis., $33,157.

Mellen, Wis.—Furnishing 26 hydrants, to the Housellaer Valve Co., Troy, N. Y.; cast iron pipe, to the United States Cast Iron Pipe Co., Chicago.

Penticon, B. C.—Installation of water works system, to MacDougall & Co., Vancouver, 20 miles of steel and cast iron pipe, intake chambers, reservoir, etc.

CONTEMPLATED WORK.

Clarksville, Ark.—The city is contemplating the building of a municipal electric lighting plant and water works system.

Exeter, Cal.—The city is contemplating the installation of a $40,000 water works system.

Delmar, Del.—A bond issue for the construction of water works system has been voted.

Americus, Ga.—Bonds have been issued for the construction of a reinforced concrete reservoir, $105,000.

Bloomington, Ill.—Construction of the East Side water system has been authorized.

Herrin, Ill.—A $33,000 bond issue for construction of water works system has been voted.

Pana, Ill.—Bonds have been voted for new machinery for water works.

Pana, Ill.—The city is contemplating the construction of a municipal water system.

Arthur, Ia.—Bonds have been voted for the construction of water works.

Luther, Ia.—A $5,000 bond issue for water works construction has been voted.

Prairieburg, Ia.—Bonds have been voted for the construction of a water works system.

Newton, Mass.—The city contemplates digging new wells, to cost about $20,000. J. Clifton Whitney, water commissioner.

Muskegon, Mich.—The city has voted $300,000 for the construction of a water system.

St. Joseph, Mo.—The city council has ordered the laying of 1,000 ft. of water mains on Sherman avenue.

Culbertson, Mont.—A $39,500 bond issue for water works system has been voted.

Decatur, Neb.—A $15,000 bond issue for installation of water works system has been voted.

Louisville, Neb.—A $16,000 bond issue for water works construction has been voted.

Upland, Neb.—Bonds have been voted for the construction of water works.

Collingswood, N. J.—The city is contemplating the construction of a municipal water plant.

Buffalo, N. Y.—George W. Fuller, 170 Broadway, N. Y., has offered a report regarding the purification of city water supply to cost about $27,000. Hypochloride of lime is recommended.

Matteawan, N. Y.—A $60,000 bond issue for water works and sewer improvements has been voted.

Middleport, N. Y.—The village is contemplating the construction of a water works system to cost $45,000.

Charlotte, N. C.—A $350,000 bond issue

for construction of water works system has been voted.

Bedford, O.—A $38,000 bond issue for water works extension has been voted.

Cleveland, O.—The city council has authorized the construction of a West Side tunnel extension for the water department, $700,000. R. Y. McCray, city clerk.

East Liverpool, O.—The city council has ordered the extension of the water works system.

Hubbard, O.—A $30,000 bond issue for the construction of a municipal water works plant has been voted.

Oak Harbor, O.—The construction of a water works system to cost $35,000 is contemplated. It is to be a deep well system.

Sandusky, O.—The city is contemplating the addition of two or more units to the water filtration plant. Address Mayor Lehrer.

Sharon, O.—The city is contemplating the construction of a municipal water system.

Butler, Okla.—The city is contemplating the construction of a complete municipal water plant.

Grove, Okla.—The city is contemplating the construction of a water works system to cost $25,000, and municipal electric plant to cost $10,000. Bonds have been voted.

Grove, Okla.—The city has sold bonds for the construction of a water works and electric light plant.

Oklahoma City, Okla.—The city commissioners have decided to build a large dam in the Canadian river for purposes of temporary water supply. Estimated cost is $25,000.

Pawhuska, Okla.—Bonds have been voted for the extension of water works and electric light plant. $60,000.

Wellston, Okla.—A $20,000 bond issue for the construction of water works has been voted.

Somerset, Pa.—The city is contemplating water works improvements to cost $12,000. L. E. Chapin, Pittsburg, Pa., engineer.

South Sharon, Pa.—The city is contemplating the construction of a municipal water works plant.

Wampum, Pa.—The city is contemplating the construction of a water works system for which $10,000 was voted last November.

White Lake, S. D.—The construction of a $16,000 water works plant is contemplated. Maderia Valley Engineering Co., Western National Bank building, Mitchell, S. D.

Dallas, Tex.—The city contemplates building water works and sewers.

Palacios, Tex.—An $18,000 bond issue for water works construction has been voted.

Rocky Mount, Va.—The city has voted $50,000 for construction of water works, electric light plant and sewer system.

Santaquin, Utah.—Bonds have been voted for water works.

BRIDGES.

BIDS REQUESTED.

Hartford, Conn.—July 31, 11 a. m. Constructing concrete piers and abutments and steel superstructure of a foot bridge over Park river. Certified check, $200. Joseph Ruths, secretary board of contract and supply.

Tampa, Fla.—Sept. 2, 2 p. m. Constructing reinforced concrete or concrete steel bridge with bascule lift. Certified check, $10,000. Allen Thomas, clerk board of public works.

Metropolis, Ill.—August 5. Constructing Green farm bridge, reinforced concrete, two 40-foot spans, girder type; Township-line bridge, reinforced concrete, 40-foot span. Geo. C. Schneeman, county clerk.

Timewell, Ill.—August 5. Constructing reinforced concrete Hiles bridge, 18-foot span. Wm. M. Robinson, town clerk.

Albion, Ind.—Aug. 8, 2 p. m. Constructing certain bridges and culverts. J. C. Kimmel, auditor.
ing certain bridges. C. H. Jennings, auditor.

Brazil, Ind.—Aug. 8, 11:30 a. m. Constructing bridge on Otter street, as noted structing complete water works and electric light plant, as noted in Bulletin of July 8. J. D. Walpole, recorder.

Brownstown, Ind.—Aug. 7, 1 p. m. Constructing three bridges, as noted in Bulletin of July 15. H. W. Wacher, auditor.

Delphi, Ind.—August 15. Re-concreting bridge between Carroll and Clinton counties. M. G. Haun, auditor of Carroll county.

Fowler, Ind.—Aug. 7, 1 p. m. Constructing seven bridges. Lemuel Shipman, auditor.

Fowler, Ind.—August 3. Constructing 7 concrete arches in various locations in Benton county. Lemuel Shipman, county auditor.

Franklin, Ind.—August 7, 1 p. m. Constructing one reinforced concrete bridge and one steel I-beam bridge with concrete floor. W. B. Jennings, auditor.

Greenfield, Ind.—Aug. 7, 10 a. m. Repairing various bridges. C. H. Troy, auditor.

Indianapolis, Ind.—Aug. 1, 10 a. m. Constructing four culverts and one bridge. C. A. Schrader, president of board of public works.

Lafayette, Ind.—August 9. Repairing Laramie bridge. George W. Baxter, county auditor.

Lagrange, Ind.—August 8. 1 p. m. Constructing ten bridges. C. S. Willard, auditor.

Madison, Ind.—August 8, 1 p. m. Constructing concrete bridge over Crooked creek. A. M. Taff, auditor.

Mishawaka, Ind.—July 26. Constructing reinforced concrete bridge and plate girder, as noted in Bulletin of July 1. W. S. Moore, South Bend, Ind., engineer.

Newport, Ind.—Aug. 7, 10 a. m. Repairing certain bridges. H. T. Paine, auditor.

Noblesville, Ind.—August 9. Constructing concrete arches for five culverts in Hamilton county. George Griffin, county auditor.

Rockville, Ind.—August 8, 1:30 p. m. Constructing concrete bridge in Sugar Creek township. Jas. E. Elder, auditor.

Rushville, Ind.—July 28, 2 p. m. Constructing various bridge work. Jesse M. Stone, auditor.

Shelbyville, Ind.—August 12, 10 a. m. Constructing two concrete steel culverts. G. B. Huntington, auditor.

Washington, Ind.—August 7, 10 a. m. Constructing several bridges. Thos. Nugent, auditor.

Shreveport, La.—August 1, 10 a. m. Constructing substructure for a steel bridge over the Red River. Certified check, $3,000. L. H. Baker, secretary-treasurer.

Bangor, Me.—July 24, 12 m. Constructing steel superstructure of highway bridge, 217 and 223-ft. spans, as noted in Bulletin of July 15. E. E. Greenwood, Skowhegan, Me., engineer.

St. Charles, Mo.—August 17, 12 m. Constructing various bridges and culverts in the county. County highway engineer.

Nebraska City, Neb.—August 16, 12 m. Constructing two concrete bridges, one 50-foot span and one 60-foot span. Certified check, $250. A. P. Young, county clerk.

Nelson, Neb.—August 16, 2 p. m. Constructing and repairing all wood and steel bridges in Nuckolls county during the en-

suing year. Certified check, $500. L. L. Shattuck, county clerk.

Massena, N. Y.—Aug. 5, 1 p. m. Constructing reinforced concrete bridge at Massena Springs. B. S. O'Neill.

Ashland, O.—Aug. 2, 12 m. Bridge construction as follows: Constructing substructure on Emanuel Treace bridge; constructing 80-ft. Warren truss superstructure for same; constructing sub-structure for Ora Glenn bridge; constructing 30-ft. Warren truss superstructure for same. Certified check, $200 on each bid. Wm. Srideler, chairman county commissioners. Lotta Westover, clerk of board.

Bowling Green, O.—August 7, 1 p. m. Constructing bridge over Portage river, in Pemberton. Certified check, $300. F. W. Toan, county auditor.

Cambridge, O.—August 8, 12 m. Building abutments for bridge at Barnes Mill. Certified check, $50. W. D. Deselm, county auditor.

Cincinnati, O.—Aug. 11, 12 m. Constructing retaining wall along Shawnee creek. Certified check, $500. Fred Driehs, clerk county commissioners.

Hamilton, O.—August 5, 10 a. m. Constructing concrete and steel bridge in Lemon township. Certified check, 10 per cent. J. E. Brate, county auditor.

Hamilton, O.—August 9, 10 a. m. Constructing bridges over M. & E. canal, on Grand boulevard; also bridge over Tallawanda creek. Certified checks, 10 per cent. J. E. Brate, county auditor.

Steubenville, O.—August 18, 12 m. Constructing superstructure of bridge No. 17. Certified check, $100. Sherman M. Floyd, clerk board of county commissioners.

Youngstown, O.—Aug. 7, 11 a. m. Constructing the sub-structure of a bridge. Certified check, $300. Will B. Jones, county auditor.

Harrisburg, Pa.—August 12, 12 m. Constructing concrete bridge over Paxton creek. Certified check, 10 per cent. D. F. Lebo, clerk county commissioners.

Washington, Pa.—Aug. 4, 12 m. Bridge construction as follows: 110-ft. truss bridge, Monongahela City; 56-ft. plate girder bridge near Bentleyville; 56-ft. pony truss in Bentleyville; 60-ft. plate girder bridge in Finleyville; 45-ft. plate girder bridge in Peters township; 40-ft reinforced concrete bridge between Charleroi and Steers; 19-ft. steel bridge in Morris township. Certified check, $200 on each bid. John H. Moffitt, county comptroller. Chaney & Armstrong, county engineers.

Benton, Tenn.—Aug. 5, 12 m. Constructing concrete substructure and steel superstructure at Reliance. Chas. E. Johnson, secretary committee.

Vancouver, B. C., Can.—September 15. Furnishing material for suspension bridges. J. F. Griffith, public works engineer, Victoria, B. C., Can.; E. McBride, road superintendent, Vancouver.

CONTRACTS AWARDED.

Pine Bluff, Ark.—The following bridge contracts have been awarded: Three concrete bridges, to M. F. Hafie, Jr., of Dallas, Tex., $3,475; steel bridge, to M. F. Leonard, of Bouie, Tex., $1,600; wooden bridge, to G. A. McNulty, of Pine Bluff, $363.

Santa Barbara, Cal.—Constructing bridge over San Lucas creek, to Charles W. Deacon, San Luis Obispo, $33,000.

Moultrie, Ga.—Constructing steel bridges over Ocopilco creek and Ocklocknee river, in Colquitt county, to the Roanoke Bridge Co.

Caldwell, Ida. — Constructing three bridge across the Payette river, to J. H. Forbes & Co., $15,875, $15,795 and $15,950, respectively.

Bloomington, Ill.—Constructing steel bridge over Sugar creek, to Burnham & Ives, $3,600.

Clinton, Ill.—Constructing bridge in Santa Anna township, to G. A. Weaver & Son, of Clayton, Ill., $2,949.00.

Elk Grove, Ill.—Constructing one concrete arch bridge and one reinforced concrete truss bridge, to H. S. Wetherell, Elk Grove.

Macomb, Ill.—Constructing reinforced concrete bridge, to Macomb Concrete Construction Company.

Springfield, Ill.—Constructing concrete bridge, to Fitzsimmons & Wheeler, $2,100.

Taylorville, Ill.—The following bridge contracts have been awarded: Vandeever bridge, to the Decatur Bridge Company, Decatur, Ill., $3,050; Kincaid and Sicily bridges, to J. A. Smith, of Taylorsville, $1,100.

Watseka, Ill.—Constructing reinforced concrete bridge across Sugar creek, to Joseph Klein, Freeburg, Ill., $7,890.

Columbus, Ind. — Constructing Powell bridge, to H. S. Fox, $1,393; constructing Burbrink bridge, to Chas. Noblitt, $420; Waymansville bridge, to same, $540; Hubbard bridge, to Harmon Bros., $551.

Geneva, Ind.—Constructing Buckingham road in Bear Creek township, to I. O. Bears, Geneva, Ind., $3,699.

Newcastle, Ind.—Constructing new bridge over Buck creek, to H. F. Burk, Newcastle, $2,249.

Clinton, Ia.—Constructing bridges 8, 16 and 22, to the Joliet Bridge & Iron Company, Joliet, Ill., $6,910.

Iowa Falls, Ia.—Constructing bridge, to the Lana Construction Bridge Co., Harlan, Ia., $8,450.

Newton, Kans.—The county is contemplating the construction of four new bridges of steel and concrete.

Duluth, Minn.—Constructing steel bridge over O'Brien creek, to Paul H. Tweed, of Nashwauk.

Livingston, Mont.—Constructing wooden approach to the Springdale bridge, to William Sworder, $950.

Missoula, Mont.—Constructing a 120-ft. steel bridge, to O. F. Peppard, of Missoula, $3,165.

Roswell, N. M.—Constructing a bridge over the South Berrendo river, to the Mid-

Montour Falls, N. Y.—Constructing abutments of South street bridge, to the Seneca Engineering Company, Seneca, N. Y. Superstructure, to the Mountour Steel Company.

Warsaw, N. Y.—Constructing steel bridge, to the Warsaw-Wilkinson Company, $2,795.

Charlotte, N. C.—Constructing bridge, at Sloan's Ferry, to the C. W. Requerth Co., Spartansburg, S. C., $57,500.

Canton, O.—Constructing concrete bridge in Plain township, to Peter Hahn & Son, of Canton, O., $1,147.

Hamilton, O.—Constructing culverts, to Roger Evans, Joseph Conrad and J. P. Quillaum.

Middletown, O.—Constructing bridges as follows: To William Fogarty, $129; to James Fackey, $368; and to J. J. Gardner, $149.

Spaulding, O.—The following bridge contracts have been awarded: Steel superstructure on three bridges, to the Delaware Bridge & Iron Company, $1,600; steel superstructures on three bridges, to Brookville Bridge & Iron Company, $3,697; constructing abutments, to Bates & Friend, $1,246; constructing of abutments, to Johnson & Ritz, $750; constructing abutments, to Hallock & Sunday, $772; constructing culverts, to A. H. Robinson, $210; constructing culverts, to Clarence Crancer, $187.

Youngstown, O.—Constructing small bridges, to the following contractors: L. W. Mentzer and Link & Henry.

Erie, Pa.—Repairing the Mill creek bridge, to Joseph McCormick & Brother.

Kutztown, Pa.—Constructing reinforced concrete bridge, to Carl R. Camp, Montrose, Pa., $10,638.

Lebanon, Pa.—The city engineer has prepared plans for a concrete bridge across Hazel Dyke, to cost about $500.

Pittsburg, Pa.—The following bridge contracts have been awarded: Constructing masonry on Davis Run bridge, Jerry Poli; constructing approaches to bridge No. 5, to Charles Asphalk, of Carnegie, Pa., $2,000.

Reading, Pa.—The construction of the Penn street bridge is authorized.

Scranton, Pa.—Constructing sub-structure of Mulberry street viaduct, sub-let by York Bridge Co., to W. H. Lyons, of Sunbury, Pa.

West Chester, Pa.—Removing the iron truss bridge from Chester creek to White Clay creek, to Corcoran Construction Co., West Chester, $1,197; erecting new 40-ft. stone arch bridge over Chester creek, to P. J. McCormick, $3,089.

Ripley, Tenn.—Constructing steel bridge over Forked Deer river, to Joliet Bridge Co., $3,347.50.

North Yakima, Wash.—Constructing a 160-ft. combination span bridge across the Yakima river, to C. E. Lum, North Yakima, $2,340.

Fairchild, Wis.—Constructing steel and concrete bridge, to Wm. Meyers, Mondovi, Wis.

Hudson, Wis.—Construction of a bridge across the St. Croix at Walnut street to cost $120,000 is contemplated.

Victoria, B. C.—Constructing a suspension bridge at Churn creek, to C. Gardiner, Johnson & Co., Vancouver.

CONTEMPLATED WORK.

Chicago, Ill.—The construction of a bridge across the Chicago river at Washington st., to cost about $360,000, is contemplated. L. E. McGann, commissioner of public works.

Michigan City, Ind.—The county is contemplating the construction of a 125-ft. bridge across the Kankakee river.

Mishawaka, Ind.—Plans have been prepared by William S. Moore, of South Bend, Ind., for the construction of a $65,000 bridge.

Shreveport, La.—$100,000 bonds have been voted to construct steel buildings for the Louisville State Fair.

Hinckley, N. Y.—Plans have just been prepared for construction of a reinforced concrete bridge to cost $14,000.

Cleveland, O.—The council has authorized the construction of the Praha avenue, S. E., bridge, $15,000. R. Y. McCraig, city clerk.

Muskogee, Okla.—The city is contemplating the construction of rock asphalt pavement, to cost $30,000.

Reading, Pa.—The county commissioners have authorized the construction of the Penn street bridge.

Wilkesbarre, Pa.—The repairing of South street bridge, to cost $15,000, is contemplated.

York, Pa.—The county commissioners the construction of bridges to cost about $47,000.

Providence, R. I.—The board of park commissioners has selected plans for a bridge at South Park, to cost about $20,000. Corbett & Higgins, architects.

STREET LIGHTING.

BIDS REQUESTED.

San Francisco, Cal.—August 3, 11 a. m. Furnishing material and labor and installing electric lighting system at Fort Miley, Cal. Lt. Col. Geo. M. K. Williamson, D. I. M. G.

Washington, D. C.—August 1, 3 p. m. Furnishing lamp standards and brackets that may be required for various buildings under control of the Treasury Department. James Knox Taylor, supervising architect.

Brazil, Ind.—August 8, 11:30 a. m. Constructing complete water works and electric light plant. J. D. Walpole, recorder.

Columbus, O.—Aug. 1, 12 m. Labor and material for 4-75 light rectifier equipments, 320 magnetite lamps, and 2 synchronous condensers. Certified check, 50 per cent. David A. Jones, clerk department public service.

Columbus, O.—Aug. 12, 10 a. m. Installing feed wires and lights in Ohio State Sanatorium, at Mt. Vernon, O. Bond, 50 per cent. B. O. Probst, secretary.

Lancaster, Pa.—July 31. Furnishing and installing lighting fixtures in the new contagious hospital, county almshouse. Certified check, 15 per cent. H. Frank Eshleman, county controller.

Union City, Pa.—Street lighting for five years, to the Union City Electric Light, Heat & Power Co.

CONTRACTS AWARDED.

Clarksville, Ark.—The city is contemplating the building of a municipal electric lighting plant and water works system.

El Modena, Cal.—The city is contemplating the installation of an electric light and power system.

Sacremento, Cal.—The state legislature has voted an appropriation of $103,000 for the gas and electric power plant.

Fort Collins, Col.—The city is contemplating the construction of a municipal electric light plant.

Albany, Ga.—A $50,000 bond issue for construction of a municipal gas plant has been voted.

Elmwood, Ill.—The city is contemplating the installation of an ornamental lighting system.

Shirley, Ind.—The city is contemplating the installation of an electric light and power system.

Melbern, Kan.—The city is contemplating the construction of an electric lighting plant.

Grand Cane, La.—The city is contemplating the installation of a complete electric lighting system.

Takoma Park, Md.—The town is contemplating the installation of an electric lighting system.

Mansfield, Mass.—A bond issue of $22,500 for construction of municipal light plant has been voted.

Marshall, Mich.—The city is contemplating the installation of an ornamental lighting system.

Bamby, Minn.—The city is contemplating the installation of an electric lighting plant.

Montclair, N. J.—The city has signed a five-year contract for street lighting with the Public Service Gas Co.

Stone Harbor, N. J.—The city is contemplating the construction of a gas plant.

Binghamton, N. Y.—Plans have been completed for a boulevard lighting system.

Valley City, N. D.—Supplying electric lamps for the city, to the Bryan-Marsh Co.

New Philadelphia, O.—The County Electric Company has been incorporated by S. L. Londen, H. K. Bradner, L. H. Purcell, M. R. Thornton, and H. Sellers, to furnish light for New Philadelphia and surrounding towns.

Grove, Okla.—The city is contemplating the construction of a water works system to cost $25,000, and municipal elec-

tric plant to cost $10,000. Bonds have been voted.

Pawhuska, Okla.—Bonds have been voted for the extension of electric light plant and water works, $60,000.

Chambersburg, Pa.—The city is contemplating improvements in the electric light plant to cost about $20,000.

Charleroi, Pa.—The city council at its meeting on July 18 will consider the awarding of contract for lighting city streets for a period of years.

Harrisburg, Pa.—The Central Pennsylvania Traction Co. is contemplating the purchase of a 1,600-k.w. generator.

Lebanon Pa.—A charter has been granted to the West Lebanon Light & Power Co. for providing light and power for the township. The incorporators are Daniel Weaver, Jacob B. Weaver, Henry Weaver, Raymond F. Bicksler and John S. Weaver.

Pottstown, Pa.—The city is contemplating the construction of electric light plant to cost about $75,000.

Smithton, Pa.—The city has granted a franchise to the Smithton Light, Heat and Power Co., for city electric lighting.

Washington, Pa.—The Washington Electric light plant has been purchased by Van Horn Ely, of New Brighton, $600,000.

Brookings, S. D.—Furnishing electric lamps, to the Bryan-Marsh Co.; transformers, to the Fort Wayne Electric Works, and wattmeters, to the General Electric Co.

Hardwick, Vt.—A $65,000 bond issue for electric lighting extensions has been voted.

Rocky Mount, Va.—The city has voted $50,000 for construction of water works, electric light plant and sewer systems.

Seattle, Wash.—Furnishing electric meters, to Burton R. Stare, $40,928.36.

Tacoma, Wash.—Installing lighting system in the court house, to Caldwell Bros., about $3,000.

Beaver Dam, Wis.—The city is contemplating the installation of an ornamental lighting system.

La Crosse, Wis.—The city is contemplating the construction of an electric light plant. Address Harry C. Wilson.

CONTEMPLATED WORK.

Minden, Neb.—Bonds have been voted for the construction of a municipal electric light plant, $15,000.

Grove, Okla.—The city has sold bonds for the construction of a water works and electric light plant.

Eugene, Ore.—The city water board will purchase poles for the city lighting system.

Plankinton, S. D.—A franchise for installing an electric light plant has been granted to W. A. Kuntze.

Walla Walla, Wash.—The city clerk will advertise for bids for furnishing electrical power for the arc and cluster lights in the city for five and ten-year periods.

Fond du Lac, Wis.—The city council has voted to install ornamental electric lights in Main street.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Paterson, N. J.—August 16. Disposing of the city garbage. Board of public works.

Cleveland, O.—August 16, 12 m. Purchasing garbage tankage of the disposal plant for period from September 1 to December 31, 1911. Ira C. Hoffman, secretary director of public service.

CONTRACTS AWARDED.

Lexington, Ky.—Cleaning streets for a period of seven months, to the Home Construction Company, Lexington, Ky.

Canton, O.—Collecting garbage for next five years, to the Sanitary Garbage Co., of Mansfield.

Erie, Pa.—Appropriations for the garbage plant have been made as follows: $12,000 for horses and wagons, $17,000 for two furnaces from the Morse-Bugler Co., New York, $11,000 for land.

Philadelphia, Pa.—Constructing municipal crematory at hospital for contagious diseases, to John R. Wiggins & Co., $8,300.

CONTEMPLATED WORK.

Newark, N. J.—The city is contemplating the installation of a garbage disposal plant.

Cleveland, O.—The city is contemplating the construction of a joint garbage disposal plant with Akron, O.

Massillon, O.—The city is contemplating the construction of a garbage disposal plant. Director of Service Pietzcker.

Oklahoma City, Okla.—The budget of the health department includes $26,700 for an incinerating plant and the purchase of an automobile ambulance.

Newcastle, Pa.—The city is contemplating the installation of additional equipment in the garbage disposal plant.

Seattle, Wash.—The city is contemplating construction of three garbage incinerators, to cost $120,000. R. H. Thompson, city engineer.

FIRE APPARATUS.

BIDS REQUESTED.

Kansas City, Mo.—August 2, 2 p. m. Constructing fire station. City purchasing agent.

CONTRACTS AWARDED.

Alice, Minn.—The village has purchased a $465 chemical engine.

CONTEMPLATED WORK.

San Jose, Cal.—A $60,000 bond issue for fire department equipment has been voted.

Thompsonville, Conn.—The city is contemplating the purchase of an auto-propelled fire truck. W. H. Hines, chief.

Boise, Ida.—A $40,000 bond issue for purchase of new fire apparatus, including an 85-ft. aerial truck, has been voted.

Belvidere, Ill.—The city is contemplating the purchase of a motor fire truck to cost about $6,000.

Ottawa, Kan.—The city is contemplating the purchase of an auto chief's wagon.

New Orleans, La.—The city is contemplating purchasing combination chemical and hose wagon motor propelled.

Bentnor City, N. J.—The city is contemplating the purchase of an auto combination wagon.

Akron, O.—The city is contemplating the extension of a fire alarm system and the purchase of motor propelled fire apparatus. Safety Director Benner.

Massillon, O.—A bond issue for the purchase of 1,000 ft. of hose has been voted.

Oklahoma City, Okla.—The estimate of the chief of the fire department for the next year includes $16,000 for extra equipment and new alarm boxes, and $5,500 for combination hose and chemical wagon.

McKees Rocks, Pa.—The commissioners have authorized the purchase of 2,000 feet of fire hose.

Honolulu, H. I.—The city and county board of supervisors contemplate the purchase of two auto fire trucks for chemical apparatus, to cost about $6,000 each.

MUNICIPAL ENGINEERING

VOLUME XLI NUMBER THREE

SEPTEMBER, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

GENERAL CHARGES.

THE items which go to make up the General Charge division of cost may be considered in accordance with the following schedule: The cost will be incurred regardless of any division of items by schedule, and these costs are just as sure as the forces of nature. They may be designated by different titles and proportioned to the estimate in different ways, but they cannot be eliminated any more than we can change the schedule time of the rising and setting of the sun, or the ebb and flow of the tide. They are just as sure and certain a cost as material and labor, and really more destructive to profits, because of the insidious accumulation through gradual and apparently trivial daily expenditures.

For our personal convenience we choose to divide these items, which go to make up the third division of cost under the second or physical divisions of the contracting organization, in this manner, although the same is not proposed as a rule but as a suggestion.

These items must be considered in the estimate, and yet to a very large extent they cannot be determined except as the result of actual experience.

The author well remembers that, when he first began contracting, it was a matter of surprise and bewilderment why jobs, which in cost of material and labor fully realized the estimate, still proved to be losers or nearly so.

It was a considerable time before it was recognized that the many small purchases were, in the end, the destroyers of profits and that it was not safe to pass them by, expecting that the items were of so little consequence that it was not worth the while to consider them in estimating.

Even today employes in the author's own organization do not or cannot understand this point, and consider that the idea is simply a method of taking care of contingencies. This is very far from the truth. These expense items are as true a cost item as material or labor.

Some engineers and contractors advocate an allowance per unit of work, as per yard of excavation, concrete, etc., to take care of these charges. Others add an amount to the estimate, sufficient in their judgment to cover the total item.

The first method is altogether wrong for the following reasons:

First—The addition of any such amount to a price per unit of work is deceptive in its after effects.

Second—Such a method can have no basis except guessing.

Third—The contractor is yet unborn who can differentiate the cost per unit for general charge items on several classes of work and arrive at any intelligent result.

Suppose we imagine an excavation for a pier foundation for a bridge construction requiring excavation, pile driving and concrete. To do this work requires pumping and lots of it, assuming the pier is located out in the stream. Invoices accumulate at the office for coal and oil, and the actual coal and oil is delivered to the job and used as occasion demands. Excavating, pile driving and concreting proceed practically simultaneously. Under these circumstances how can we arrive at any fair cost per unit for fuel and oil? If the attempt is made to distribute the cost in any proportion to the various kinds of work it can only be done by arbitrary methods, which will not bear analysis.

Take another item, viz: Petty Tools. In this classification belong shovels. And what contractor is wise enough or sufficiently in touch with his work to say what proportion of this cost should go to excavation and what to concrete?

Take the Fitting and Repair account. Who can say with any certainty how much of repairs to pumping machinery should

be charged to excavation and how much to pile driving and concrete?

The fact is that all these charges are directly dependent upon the kind of work under construction, and the various jobs will show a greater or less cost along this line in direct relation to the difficulties encountered.

Therefore it follows that the various kinds of work should be separated into definite classifications with respect to the difficulties surrounding construction and each contractor's experience and their percentages ascertained to be added to the estimated cost, to take care of all the items of general charge.

Such classifications have been prepared by the author for his own work, and it has been found that for work of similar character it is really surprising how closely the percentage of cost of these items will compare, even when small and large jobs are in the same list.

The second consideration is the method of application of any such percentages. If the percentage is added to the complete estimated cost of material and labor the results will show wide variation, due to the fluctuation in cost of material. If proportioned over material only, the result will vary still more. The only logical method is to distribute this cost by a percentage on the cost of labor only. This theory is based on the following facts:

First—The labor for the same kinds of work is more really constant than the cost of material.

Second—The contractor must always furnish labor, whereas material may be entirely eliminated; reduced in price by concessions as to transportation, as in railroad jobs with free haul; or, as in cases of work at some distance from railroad facilities, the cost may be greatly increased by delivery cost.

3A—The higher the grade of work the more the cost of labor and the more cost per man hour.

3B—The more difficult the work the greater the cost of labor and the less output per man hour.

3C—The higher the grade or more difficult the work the less output per dollar of expenditure for pay roll.

Granting these conditions, the cost of labor is the measure of efficiency of the work management, and to secure comparable results and proper idea of costs as a basis of efficiency the general charges must be determined by a percentage on labor. This conclusion being always governed by a due consideration for the kind of work.

The more thought given to this conclusion the more it will impress itself on the individual as a truth. Consider any type of construction with which you are familiar and the method will gain in impressiveness with each illustration considered.

Take such a case as heavy, wet excavation. The cost of labor is naturally more than for dry excavation. So also is the cost of all the items going to make up the general charges. For this class of work the increase in general charges will show most in Fuel and Oil, Fittings and Repairs, and Expense. High-grade labor is not employed on this class of work, but suppose we have stonemasons building a piece of masonry which must be carefully cut and fitted. Fuel and Oil and Fittings and Repairs are low in this case, but Expense will be large in proportion to pay roll on account of dressing of tools, etc., and the output per dollar of labor is small. The two illustrations are not comparable and belong in separate classifications, and are mentioned as illustrations of the principles involved.

This method has been applied to 125 jobs, covering ten years of work, and it has been found that really definite comparable results are obtained, where before by other methods the estimates were largely a matter of guess.

In using the percentage method it is always wise to prepare a check estimate by a mental review of the job under consideration and deciding whether the amount determined by percentage, as a result of past experience, seems reasonable.

The schedule or division of General Charges, as suggested, is as follows:

First—Contract Bonds, Maintenance Bonds, etc.

Second—Liability Insurance, comprising Employers' Liability, Public Liability and Workmen's Collective Insurance.

Third—General Expense, items as per list.

Fourth—Petty Tools, as per list.

Fifth—Fuel and Oil, as per list.

Sixth—Fittings and Repairs, as per list.

Seventh—Commissary, where necessary, as per list.

Eighth—Interest.

Ninth—Machinery and Equipment.

Tenth—General Office and Supervision.

In establishing any such schedule as the foregoing it will be recognized that the bookkeeper cannot, day by day, record the general charges in such a way that all jobs, past, present and future, may be compared with reference to the same item, unless a general rule be adopted as to what shall be charged under each heading. Inasmuch as bookkeepers change, but the system must continue, and to preserve a decision once made, it is well to prepare a standard list of the ordinary purchases. Such a list has been prepared for each of the above headings.

In considering Bonds and Insurance, information and rates have been given at

considerable length. The contractor, located in a large community, may not find these data as valuable as the man who is not as closely in touch with a well-informed agent, but for reference and comparison and for purpose of estimating, this information is indispensable. It is, however, advised that wherever possible an agent of the bonding and insurance companies be called upon for verification. Incidentally it should be noted that liability insurance is computed on the pay roll at various rates, according to the hazard of the occupation, thereby adding weight to our contention that the other items of General Charge should also be so adjusted.

Inasmuch as we have insisted that, in estimating, material and labor should be separated, there is no difficulty in the application of this method.

It will be found that for different kinds of work, under various conditions, the proportion of cost of labor with respect to the cost of material will run quite uniform, and if a record is made of these percentages it will assist a great many times in approximate or preliminary estimates.

Now proceeding in detail with reference to each item of General Charges:

BONDS.

The information herewith furnished, with reference to bonds, is according to the manual of fidelity and surety bonds furnished by the courtesy of the Equitable Surety Company, of St. Louis, Mo.

Contract bonds are classified as (a) construction; (b) supply; (c) maintenance.

Construction contracts are those where the work contracted for forms part of, or becomes attached to real property, when the contract in question is completed. When contract for repair or erection of any work classified as construction includes, within the same contract bond, the furnishing of any building material, the entire contract is rated as a construction bond. When the contract is solely for the furnishing of building material and does not include any installation, the contract may be classified as a supply bond.

The rate or premium applicable to construction bonds for usual kinds of contract work is based on a rate of one-half of one per cent. per annum on the contract price. Note this rate is figured on the contract price and not on the amount of the bond; also note that the premium is per annum, and should the work extend over more than one year, allowance must be made for renewal of the same premium. It should also be understood that the premiums are due from the date of the bond, whether actual work begins immediately or not.

Supply contracts may be figured at the rate of one-fourth of one per cent. per annum on the contract price and include the furnishing of supplies, material and machinery of stock design. Machinery, etc., made to special order requires a premium of one-half of one per cent., the same as construction contract. Any labor connected with installation of supply contracts must be figured at the construction contract rates.

Many times it is necessary to furnish a bid or proposal bond. The usual rate for a bond of this character is $5.00 each, and this premium is considered fully earned whether the proposal is successful or not. Should the proposal be successful the premium for this bid bond shall be applied as a part payment on the premium for the contract bond, provided the bond is taken from the same company.

The minimum premiums on construction contract bonds are as follows:

First—Where the bond does not exceed $500.00 and the contract does not exceed $1,000.00; bonds $5.00 each.

Second—Where the bond is over $500.00 or the contract is over $1,000.00; bonds $10.00 each. It will be noted that these minimums require that a contract shall equal $2,000.00 or more before the regular rate of one-half of one per cent. would equal the minimum premium.

There are maintenance bonds of two kinds, viz: Those covering the guarantee of the entire construction work and those where the guarantee only covers a part of the construction work. In the first case the premium rate for maintenance bonds is $1.25 per thousand per annum computed on the contract price, and in the second case $1.25 per thousand per annum computed on the value of the guaranteed work. The premium for the maintenance bond for the entire term of the guarantee is due in advance at the time the construction bond is issued.

It is just as important to the contractor to have a credit line with some well-established bond company as to have a credit with his bank. The standing of any contractor with the bonding company depends on two conditions: (a) Financial standing; (b) moral hazard.

Within reasonable limits a bonding company will extend greater favor to the good moral hazard than to the contractor of better financial standing but with a poor record for fulfilling his obligations.

Many states and municipalities, also the United States government, have special requirements regarding bonds, and it is always well to consult an agent to be sure that the standard rates will apply on any new work. The foregoing rates are standard for all ordinary work.

Inasmuch as the premium on bonds, regardless of the amount of the bond, is computed on the total amount of the contract, which includes material, labor, gen-

eral charge items and profit, we must either compute the bond cost separately from other items of general charge or increase the rates in proportion to the percentage which the pay roll bears to the cost of material and labor. The more accurate method is to complete the estimate, except the bond, and then add the cost of the bond plus the same percentage of profit as used for the general estimate. For all practical purposes, however, sufficiently accurate results are obtained by including the bond cost along with other items of general charge. As our system requires that material and labor be separated in the estimate. we are able to arrive at once at the percentage the pay roll bears to material and labor. By referring then to chart plate IX (to appear in the October number), the proper per cent. to be included in the general charge and added to the pay roll may be ascertained. For instance, if the labor represents 50 per cent. of the cost of material and labor the percentage to be included in the general charge and added to the pay roll is one per cent. If the labor represents 20 per cent., or one-fifth of the cost of material and labor, the per cent. to be included in the general charge and added to the pay roll is 2½ per cent. Naturally if the contract is all labor and therefore all pay roll, therefore representing 100 per cent. of the cost, the rate will be one-half of one per cent. At 10 per cent. labor the per cent. to be added to the pay roll increases to five per cent, but a contract with such a small amount of labor is unusual, and it is recommended that jobs of this character with 10 per cent. or less labor be calculated by the method first suggested. When we have a job with 10 per cent. or less labor we are verging on a supply contract, and it is probable that the cost of the bond can be decreased by a proper division of the work under the headings of construction and supply.

LIABILITY INSURANCE.

Liability insurance is not accident insurance, as some employes seem to understand. Contractors' liability insurance (E. L. policies) is essentially insurance against the contractors' liability for damages because of accidents to any of his employes. It is, in fact, a contract between the contractor and the liability company whereby, in consideration of a certain fee to be paid by the contractor, the liability company agrees to furnish the first or emergency medical aid and to save the contractor harmless from any and all claims as damages up to the limits of the policy. The usual limits of the policy are $5,000 and $10,000, meaning thereby $5,000 for any one individual judgment or $10,000 for any one accident. The latter being the limit for an accident when a number are injured and where the aggregate amount of judgments does not exceed this amount. Almost any limits will be accepted by the liability insurance companies, but the ones named are usual. Any increase of the limits is naturally accompanied by an increase in the rate of premium.

The contractor should consider that his rating or credit with his liability insurance company is as important to a large extent as his credit with his bank or bonding company.

Both the bank and the bonding company gauge the contractor by his financial standing and his general reputation for fulfilling and satisfying his obligations.

The liability insurance company judges the risk in light of its past experience on similar work, but tempers its decision by the standing of the contractor as to his experience, methods and disposition to cooperate with the company to secure reports, records and settlements. A contractor by establishing a good rating may gain the advantage of a close rate, whereas by a poor record he may even go so far as to be refused by one company after another. The interests of the contractor and the liability company are identical and there should be a close co-operation.

The minimum premium for liability insurance is $50, and the only way to avoid an increase in cost, due to this fact when many small contracts are handled, is to secure a general, annual or blanket policy covering all work of any character. Naturally on large work this feature is of no consequence.

The possibility of accidents to the public and the employes of others must be considered, especially where the work is located in a city or town and where others are working on the same contract. To provide for this contingency public liability insurance (P. L. policies) is furnished at a somewhat less rate than for employe insurance.

Workmen's Collective Insurance is now required in some states and is a feature of the insurance cost which will require more consideration in the future, although very infrequently at the present time.

Briefly, this class of insurance may be considered as accident insurance. The rates for the same vary with the class of work. The benefits are:

(a) In the event of death within ninety days a sum equal to, but not exceeding, one year's wages, limited to $1,500.

(b) For the loss of two limbs or two eyes a sum equal to the amount payable under the policy at death.

(c) For the loss of one limb, a sum equal to one-third the amount payable under the policy at death.

(d) For the loss of one eye a sum equal to one-eighth the amount payable under the policy at death.

(e) In the event of temporary total disability a sum equal to, but not exceeding,

one-half the weekly wages for a period not exceeding twenty-six weeks, such sum not to exceed $750 in respect of any one person injured during the policy year.

These benefits are for accidents occurring only during working hours, but by an additional charge of 15 per cent. the policy may be written to cover the whole 24 hours. The brief abstract of standard rates heretofore appended gives a general idea of the cost of employers' liability, public liability and workmen's collective insurance. This table is not intended to cover the entire field of contracting work, but sufficient examples are given to serve as a guide in general contract work.

The rates in this table do not include the hazard due to blasting, unless specifically mentioned. The rates as given are for Illinois, Iowa, Missouri and Nebraska and for all other states by use of the proper differentials.

Many states, by arbitrary legislative enactment, have increased the cost of liability insurance very materially. The intention has been to protect the interests of the workman, but it must not be overlooked that the public must pay the bill in the increased costs of all building operations. The workman is certainly deserving of a certain protection in his line of work, and the economic interest of the community at large justifies a recompense to him or his family for injuries or loss of life, but this result cannot be obtained without a corresponding increase in cost of every building project.

In other words, every contract carries, in addition to the cost of material, labor and supplies, the cost of human effort expressed in loss of time and suffering due to injury and death. This cost is just as true a one and more far-reaching, and should receive its proper recognition; but only by legislative action can this cost be distributed over the entire community and be included in all proposals, which is the essential thing in its effect on the contractor.

The only regret is that such laws are abused by malicious and scheming employes, abetted and assisted by shyster attorneys, to the end of defeating the very purposes of the legislation, thereby making the matter of all claims the subject of distrust and antagonism.

Any prudent or responsible employer of labor cannot afford to be without the protection of liability insurance, for to carry your own risk invites litigation and loss. A minor may have an accident today but can defer suit for seven years; therefore liability insurance should be carried in a well-established company of financial strength. Fire losses cannot exceed the value of your property, but liability for personal injuries cannot be estimated.

TABLE I.

ABSTRACT OF STANDARD LIABILITY INSURANCE RATES—ILLINOIS, IOWA, MISSOURI AND NEBRASKA, SIMILAR TO RATES OF OTHER STATES, BY USE OF DIFFERENTIAL TABLE.

(Courtesy of United States Casualty Company.)

	Employees' Liability	Public Liability	Workmen's Collective
Asphalt layers—street or sidewalk, including yards and shops.	$1.00	$1.00	$2.00
Blasting—add 20 per cent. to E. L., P. L. and Coll. rates, to cover blasting hazards, except in those classifications where blasting is specifically included	...	.....	.....
Bridge building, metal	7.50	2.00	4.00
Bridge building, wood	4.00	1.50	4.00
Building raising, shoring building, removing walls, foundations, columns and piers and rebuilding same	7.50	3.00	4.00
Building movers	5.00	3.00	4.00
Caisson work for foundations of subaqueous operations, with or without blasting, including work under air pressure	10.00	.50	4.00
Canal excavating, not irrigation ditch digging	5.00	1.00	4.00
Carpenters, construction away from shop, not bridge building nor grain elevator construction work	2.25	.75	2.50
Carpenters, grain elevator erection	4.00	.75	2.50
Cellar excavation, no caisson or subaqueous work, including digging holes and filling them with concrete for foundations for buildings	3.50	1.00	2.50
Chimney work, concrete, stone or brick construction, not structural iron or steel	7.50	1.50	2.75
Clay digging, no canal, sewer or cellar excavation or mining	2.25	.50	2.50

Cleaning and renovating stone fronts of buildings, no construction work	3.50	1.50	2.00
Concrete work:			
(a) Bridge abutments not more than 20 feet in height from the base, including making, setting up and taking down of frames and false work	3.00	1.00	2.00
(b) Bridge abutments over 20 feet in height from the base, including making, setting up and taking down of frames and false work	4.00	1.50	2.50
(c) Bridge or building foundations except caisson work	3.00	1.00	2.00
(d) Bridges, including making, setting up and taking down of frames and false work, except caisson work	5.00	1.50	2.50
(e) Buildings, not grain elevators, including making, setting up and taking down of frames and false work	4.00	1.50	2.50
(f) Floors or pavements not self-bearing	1.25	1.00	2.00
(g) Grain elevators, including making, setting up and taking down of frames and false work	5.00	1.00	2.50
(h) Sidewalk laying, including shop and yard work	1.00	1.00	2.00
(i) Unit-system construction of concrete columns, beams, roofs, walls and floors in sections, including subsequent erection of same	7.50	3.00	4.00
Masonry work	2.50	.50	2.00
Carpentry work	1.75	.50	2.00
Concrete work	3.00	.50	2.00
Ditch digging, irrigation or drainage only, no sewer or canal building	1.50	.25	1.50
Dredging by floating dredges	2.25	.50	2.50
Fences, wood, stone, metal or concrete, not over 6 feet high, construction of	1.50	.50	1.25
Galvanized iron and sheet iron workers, erecting and repairing.	3.00	1.00	4.00
Gas works, laying of mains and connections; no tunneling. Employers' liability rate excludes gas explosion ,inhalation or asphyxiation	3.00	1.50	2.50
Grade crossing work, involving all work incidental thereto, excluding iron and steel erection work or the laying of new sewers and excluding accident to railway passengers or by any trains except work trains	4.00	1.00	2.50
Grain elevators, concrete, including making, setting up and taking down of frames and false work	5.00	1.00	2.50
Iron men, erecting steel and iron frame structures, no bridge building	7.50	3.00	4.00
Jobbing work on private residences not exceeding three stories and basement in height, and on private stables and garages.	2.00	.50	2.00
Jobbing work on buildings other than private residences, excluding remodeling and new construction work	2.75	.75	2.50
Marble and stone setters, inside construction only, including decoration in place	1.00	.25	2.50
Marble and stone setters outside of buildings, away from shop	3.50	1.00	2.50
Masonry work, not otherwise classified	3.50	1.00	2.50
Mosaic work, floors only within buildings	.75	.25	1.00
Paperhangers	1.00	.25	2.00
Parquet floor laying	.75	.25	1.00
Pile drivers, including timber wharf building thereon, if any	4.00	.75	3.00
Pile driving for building foundations	4.00	1.50	3.00
Plasterers	1.00	.25	2.00
Plumbers, shop and outside work, no division of pay roll allowed	1.00	.25	1.50
Road or street making	1.50	1.00	2.50
Roofers, gravel and composition only	2.00	1.00	2.00
Roofers, all other kinds	3.00	1.00	2.75
Sand and gravel diggers, no canal, sewer or cellar excavation or grading	2.25	.50	2.50
Sand excavation by means of suction dredges, including loading and unloading at docks, wharves and elsewhere	2.25	.50	2.00
Sewer building, no limit of depth, with or without blasting	7.50	3.00	3.00
Sewer building, maximum depth of excavation 12 feet at any point, with or without blasting	6.00	3.00	3.00

Sewer building, maximum depth of excavation 7 feet at any point, with or without blasting	4.00	3.00	2.50
Steam, electric street or interurban railway construction, earth work only, no explosives and no tunneling	2.25	(a)	2.50
Telegraph or telephone, construction exclusively	3.00	2.00	2.50
Trestle building, wood	4.00	1.00	2.50
Water towers and standpipes, erection of	7.50	1.50	4.00
Water works, construction of pumping station and the making of dams, reservoirs, excluding erection of water towers and standpipes	3.00	.50	4.00
Water works, laying of mains and connections	3.00	1.50	2.50

The Ohio State Experimental Road.

Editorial Correspondence.

THE State of Ohio has been exceptionally progressive in the matter of investigating new and improved methods of road construction, as well as in constructing by means of the "state aid" plan. Such roads are conceded to be equal to any to be found in the United States. Intelligent, honest effort to ascertain the best forms of construction has characterized the state highway department for a number of years.

In accordance with this principle of investigation it was decided in 1909 to construct an experimental road, upon which were to be laid sections of the various kinds of preparations for preventing dust and binding sections of macadam roads. This work was undertaken through the efforts of James C. Wonders, at that time highway commissioner, and an appropriation was made by the legislature to carry on the work. A section of old macadam road was chosen for the experiment.

In preparing for the work, letters were addressed to the different firms advertising road-building materials, and they were advised of the intention to build this experimental road and of its scope and purpose, and the hope was expressed that all manufacturers would show their confidence in their product by participating in the work. With few exceptions the firms addressed complied with the request and applied their materials on the road. The highway department paid for all labor and materials required in the work, but stipulated that each firm should furnish an expert to superintend its particular section, in order that the work should be constructed exactly according to the manufacturer's ideas. In addition to the above-mentioned work, a few sections were constructed using Portland cement as a binder.

The surface of the road was carefully leveled, and it will be possible to ascertain the amount of wear by releveling at various times.

In 1910 an official inspection of the road was made and photographs were taken to show the progress of wear on the different sections. Since that time no inspections have been made by the highway department, though D. W. Seitz, who has been connected with the experimental work since its start, states that an inspection will be made this fall and at succeeding intervals until the results are fully determined.

At the present time the road shows a marked differentiation between the classes of treatments used, though the distinction between the different kinds of the same class of materials is not evident. It is possible at this time to state that certain sections are showing evidences of deterioration and that others are "holding up" to a degree which indicates that it will be two or three years before they can be divided so as to say which is the best.

There are seventeen sections in this experimental road, each section being of sufficient length to give a fair trial. In the description and comment that follow, the sections are taken up in the order in which they occur, the first three being north of a little village, the fourth and fifth within it, and the other twelve being south and in the open country. A nine-ton road roller which passed during the inspection made notable depressions in some of the sections.

EXPERIMENT NO. 1—GLUTRIN.

This material was applied on a well-constructed, two-course macadam road that had been thoroughly rolled and bonded. Glutrin is prepared from materials produced during the manufacture of cellulose. It is described by the manufacturers as a "calcium-magnesium-ligno-sulfonate, and at the specific gravity of 1.26

SECTION I. GLUTRIN.
Ohio State Experimental Road.

at which it is sold, contains probably about 18.00 per cent. of glucosides." It is a viscous liquid, soluble in water, and in addition to its binding qalities, it is said to form a chemical action upon the road material that increases the flow of the binder, which results from the action of water upon the road metal.

The surface of the macadam was sprinkled with water, and while it was still damp, glutrin was applied by sprinkling with an ordinary road sprinkler. Two applications were made, a day elapsing between the first and second applications. The road was ready for travel in four hours after each application.

Except for a somewhat dusty condition the road is compact and solid and has much the appearance of water-bound macadam, though it is brownish in appearance. The application of the glutrin each year would no doubt alleviate the one objectionable feature of dust. Photograph 1 shows this section.

EXPERIMENT NO 2—STANDARD MACADAM ASPHALT BINDER.

The section of road on which this treatment was applied was first prepared in the usual manner of treatment for the lower course of a water-bound macadam road. Crushed limestone, ranging in size from three inches to one and one-half inches, was then spread to a depth of about three inches. This course was then rolled with a ten-ton roller until it presented a fairly smooth and uniform surface. The asphaltic binder, which had been heated in a small tank at the side of the road, was then applied by means of hand sprinkling cans. About one and one-half gallons of the binder was used for each square yard of surface treated. Screenings varying in size from one-half to three-fourths of an inch were then spread upon the road the road and the roller again brought into use. Additional screenings were added where the binder appeared on the surface, and this work of rolling and adding screenings continued until no more binder appeared on the surface. On a portion of this section a second coat of the binder, consisting of from one-fourth to one-half of a gallon per square yard was applied, followed by another coat of screenings and more rolling.

SECTION II STANDARD ASPHALT BINDER.
Ohio State Experimental Road.

SECTION III. PIONEER ASPHALT BINDER.
Ohio State Experimental Road.

EXPERIMENT NO 3—PIONEER ASPHALT CEMENT.

The material used as a binder in this experiment is refined from rock asphalt mined in Utah. In the construction the construction the foundation course was finished as a water-bound macadam road, thoroughly rolled and bonded. The second layer was composed of stone ranging in size from one and one-half to two and one-half inches. This was rolled to a finished depth of about two inches, no water being used. One-half to three-fourths inch screenings were broomed into the surface in a quantity sufficient to reduce the voids about 50 per cent. The asphaltic cement was then poured at a temperature between 390 deg. and 410 deg. F., until all of the stone was thoroughly coated. When the coating had cooled, a thin dressing of screenings was sprinkled over the surface. These screenings were sprinkled but a short distance ahead of the roller, which followed immediately after the screenings were placed. The screenings were sprinkled at first in a thin layer, and as the rolling proceeded more screenings were added, until the coating had absorbed all the screenings which it was possible to absorb. The quantity of the binder used was one and one-fourth gallons per square yard.

The surface is smooth, dustless and in excellent condition with no excess of binder. Photograph 3 indicates this condition.

Asphalt has been forced to the surface to a degree that it has flowed to the side of the road. The temperature at the time of inspection was only about 85 degrees and yet the imprint of the horses hoofs was plainly visible at points on the surface where the asphalt had exuded to a great extent. Excepting for these points the surface is hard and dustless, Photograph 2 shows this section.

EXPERIMENT NO. 4—TARVIA "X."

In the preparation of Tarvia X, ordinary coal tar is heated to drive off the water and ammonia. The road was prepared for this treatment in a manner similar to section No. 3, except that the stones in the top course were from 1½

SECTION IV. TARVIA "X" BINDER.
Ohio State Experimental Road.

SECTION V. TARVIA "B" SURFACE TREATMENT
Ohio State Experimental Road.

to 3 inches in size. No screenings were used. When this course was thoroughly dry, the refined tar, under pressure, at a temperature of from 250 deg. to 300 deg. F., was spread over the surface by means of a hose attached to a tank wagon. The tank was hauled by a steam roller to avoid the displacement of the stone that would be caused by horses' feet. By the use of the tank wagon the tar was kept heated and under pressure, and this method of applying the tar greatly facilitated the work. The time required for one pouring over the entire section was about one-half hour.

This section shows evidences of dust, due, doubtless, to the fact that a number of cross-streets in the village contributed a portion of their surface. The larger stones are in places exposed and worn, but were held firmly in place. Photograph 4 shows this section.

EXPERIMENT 5—TARVIA "B."

This material is a tar preparation that may be applied without heating. In this instance it was placed on a macadam road that had been filled and rolled, but had not been watered, and had been under travel for about two weeks. In making the application, all of the dust and dirt was carefully swept to the sides of the macadam, and on the clean surface the binding material, which had been heated for this work, was applied by means of the same tank wagon that was used for Tarvia "X." Two-thirds of a gallon was used per square yard. As soon as the Tarvia had been applied the dust that had been removed from the road was swept back over this surface.

This section is in excellent condition—superior, in fact, to the section just mentioned. It is hard, perfectly smooth and dustless, as is shown in Photograph 5.

EXPERIMENT NO. 6—LIQUID ASPHALT.

The material used in this section is the Indian Refining Company's heavy asphalt binder, said to contain 90 per cent. asphalt. It was shipped in barrels and was heated for use on the road in a large heating tank. The barrels were rolled on skids to the top of the heating tank, and when in place one head of the barrel was knocked in and the material allowed

SECTION VI. LIQUID ASPHALT BINDER.
Ohio State Experimental Road.

SECTION VII. UGITE BINDER.
Ohio State Experimental Road.

to flow out of the barrel thus opened. Notwithstanding the fact that the weather was very warm while this work was being done, the material was so heavy that it flowed very slowly, and several minutes were required to empty a barrel in this manner. The material was heated to a temperature of about 200 deg. F. and applied to the road under conditions similar to those used for the "Pioneer asphalt," described above.

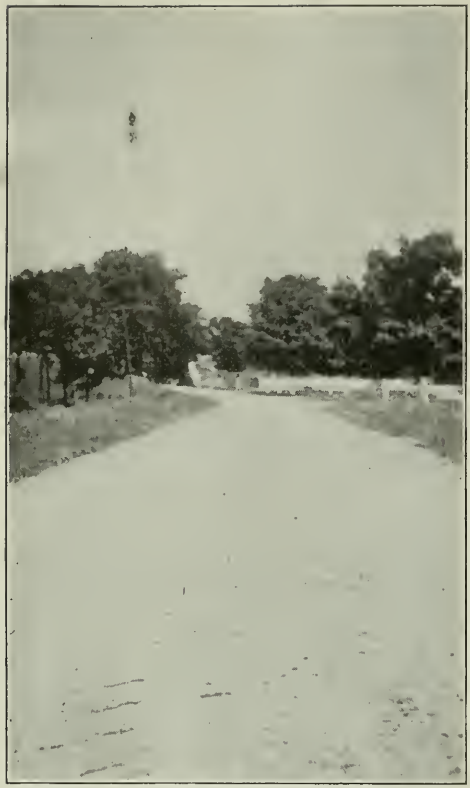
The larger stones are exposed in this section, but there are no signs of loosening or raveling. The surface is dustless, hard and smooth. Photograph 6 shows this condition.

EXPERIMENT 7—UGITE.

The material used in this treatment is said by the manufacturers to be a true tar, made by treating water gas tar in such a manner that the hydro-carbon compounds of the paraffins in the water gas undergo a chemical change, resulting in the production of a true tar, without producing free carbon, which is commonly found in the coal gas tars; consequently, a material that does not have the deep black color of the ordinary tar. The treatment was applied in two different ways, as follows:

At the beginning of the section, extending south for a distance of 273 feet, after rolling in sufficient ¾-inch stone in the top course to bind it well, 2.05 gallons of the tar were poured on the road, at a temperature of 240 deg. The maximum air temperature during this work was 87 deg., the minimum 75 deg. and the mean 81 deg. F. The tar was heated in a small heating tank placed at the side of the road, and the average rate of application on this part of the section was about 1,200 gallons per day. After pouring the tar on the road a small quantity of ¾-inch stone was then applied, just sufficient to keep the roller from the tar compound, and the surface was well rolled. Stone chips about ½ inch in size were then spread on and well rolled in. A light coating of ¼ inch screenings and dust was put on, to protect the road surface until the compound had a chance to set up. This was rolled until firm. On the remainder of the section, 127 feet in length,

SECTION VIII. FAIRFIELD ASPHALTIC CEMENT
Ohio State Experimental Road.



SECTION IX. ASPHALTOILENE BINDER.
Ohio State Experimental Road.

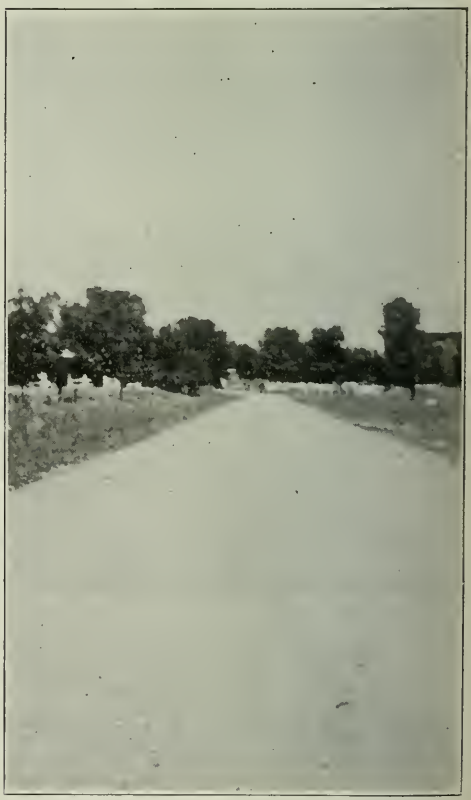
the compound was applied in two coats. On the top course of stone, which had been filled previously with ¾-inch stone, well rolled in, 1.67 gallons per square yard was poured, at a temperature of 250 deg. F. This was applied at the rate of 1,000 gallons per day. Sufficient ¾-inch stone was spread over the surface to keep the roller from sticking and was well rolled in. A surface coating of .44 gallons per square yard, at a temperature of 280 deg. F., was then put on at the rate of 3,000 gallons per day. One-half inch chips were put on and well rolled in. This was followed by a light coating of ¾-inch screenings and dust, to protect the road surface while setting up. On this section, therefore, there was applied a total of 2.11 gallons of the compound per square yard.

The weather conditions during the construction of the second part of this section were slightly unfavorable, due to a shower at night, which delayed the completion of the rolling of the section.

This section seems to be in the same condition throughout, no difference being evident, due to the two methods of construction. At one point on the road, where the seepage water from an overhead railroad crossing had dripped on the road surface, the binding material has been entirely removed from about the stones, leaving them entirely exposed. This erosion may be due to the fact that the water has dropped through a distance of about 15 feet, and may not indicate that the binding material is likely to be washed away when ruts and hollows furnish an opportunity for the water to act on the road surface. Photograph 7 shows this section.

EXPERIMENT NO. 8—FAIRFIELD ASPHALTIC CEMENT.

This material, which is described as a refined asphaltic cement, was applied to the top course of a two-course macadam road. This top course consisted of stone from 1½ to 3 inches in size, in a layer 4 inches thick, and it was thoroughly rolled before applying the asphalt, but without any screenings or other filler. The asphalt was heated in a small heating tank at the side of the road, and applied



SECTION X. WADSWORTH MACADAM BINDER
Ohio State Experimental Road.

on the road by the use of buckets. The work was done about the first of August, when the weather was extremely warm. The asphalt had been shipped in barrels, and it was so heavy and viscous that in order to remove it the barrels were cut in halves with axes, and on account of its adhering to the staves it was frequently necessary to throw them into the heating tank to save the material. After the asphalt had been applied, stone chips, varying in size from ½ to ¾ of an inch, were applied to the surface of the road to a depth of about ½ inch. This was then thoroughly rolled, the chips being forced into the voids of the macadam, and also forming a surface over the top which prevented the asphalt sticking to the roller. When this rolling was completed, the road was ready for travel.

adam road prepared after the manner of experiment No. 8, excepting that the stone in the top course ranged in size from 1 to 2½ inches. The material was heated in a small heating tank placed at the side of the road and poured on the road with buckets.

After the asphaltoilene had been applied, ½-inch stone screenings and dust, in about equal parts, were spread over the surface of the road to a sufficient thickness to fill the voids and make a smooth and uniform surface, and the road was rolled until it was thoroughly consolidated and the asphaltoilene showed a tendency to stick to the wheels of the roller.

This section showed plainly the marks of the traction engine wheels, and also the prints of horses' hoofs, much after the manner of an asphalt pavement. The

SECTION XI. CARBO-VIA BINDER.
Ohio State Experimental Road.

This surface is in splendid condition, and even under the weight of the 9-ton roller mentioned, it did not show marked depressions where the calks on the wheels had pressed. Photograph 8 shows this section.

EXPERIMENT NO. 9—ASPHALTOILENE.

In the manufacturer's description of this material it is stated that it "is made from a heavy natural oil with an asphalt base and not containing paraffin. This natural oil contains so little of the illuminating oils or valuable products that it is not worth refining for their extraction. It is, therefore, never 'cracked' or coked, but contains a high percentage of liquid asphalt with sufficient oil to act as a solvent and vehicle."

This material was applied on a mac-

surface is smooth and dustless, as will be noted from Photograph 9.

EXPERIMENT NO. 10—WADSWORTH MACADAM.

This material is Kentucky rock asphalt, very finely ground. It was applied on the top course of a macadam road, prepared after the manner of experiment No. 9. About one inch of the asphalt was spread over the surface of the stone and evenly distributed with hand rakes, and then thoroughly rolled with a steam roller, forcing the asphalt into the spaces between the stones. This probably penetrated beneath the surface of the stone for an inch or more. After this had been thoroughly rolled, another layer of about one inch of the asphalt was spread, and this was again rolled thoroughly. This material was applied in warm

SECTION XII. CONCRETE MACADAM.
Ohio State Experimental Road.

weather, but without artificial heat. When first completed the road tracked very readily; horses' feet and the wheels of vehicles marked it in such a manner that it seemed that it would soon be destroyed. After a few weeks of travel, however, the surface began to get firmer, and in a short time became very smooth.

It is said that for some time after the completion of this section, the surface was so soft as to be easily marked by horses' hoofs and buggy wheels. At the present time the surface is excellent. It is as smooth and dustless as an asphalt pavement, and even under the weight of the 9-ton engine it showed very little evidence of depression from the wheel calks, and absolutely no trace of any cutting of the surface. This section is shown in Photograph 10.

EXPERIMENT NO. 11—CARBO-VIA.

This material is a refined coal tar product. It was applied on a macadam road prepared after the manner of experiment No. 9. The material was heated to a temperature of about 300 deg. F., in the same tank that was used for experiment No. 9, and was poured on the road with hand sprinkling cans. In making the first application about 1½ gallons per square yard were poured. Immediately after the pouring the surface was rolled with a steam roller, the wheels of the roller having been oiled with an emulsion of kerosene and water, to prevent the carbo-via from adhering to the roller. After this rolling, a thin layer of stone chips was swept into the voids, and the surface was again rolled. About ½ gallon of carbo-via per square yard was then applied and rolled as before and covered to a depth of about ¾ inch with stone screenings and dust.

This section is hard and comparatively smooth, as is shown in Photograph 11, but it is not entirely free from dust.

EXPERIMENT NO. 12—CONCRETE MACADAM.

The construction of this section was practically the same as that of a water-bound macadam road, except that Portland cement was mixed with the screenings for the binder of the top course, with the expectation of increasing the cementing power of the stone dust. The

SECTION XIII. TAROID BINDER.
Ohio State Experimental Road.

cement was mixed with the dry screenings in the proportion of one part of cement to six parts of screenings. The mixing was done by hand on board platforms placed at the side of the road, the mixture being turned until it was of a uniform color. Upon the lower course of macadam, which had been shaped, rolled and thoroughly bonded, was spread a layer of limestone varying in size from 1½ to 3 inches, to a depth of about 3 inches. After this course had beeu thoroughly rolled, the above described filler was applied dry, using a spreading motion of the shovel, the rolling being continued during the process of filling until all of the voids were completely filled. Water was then applied and the rolling continued until a wave of grout was produced in front of the roller over the entire surface. This section was closed against travel and the surface was kept damp by repeated sprinklings for several days after the work had been completed.

This section has much the appearance of water-bound macadam; in fact, the addition of the cement seems to have added nothing to the merits of the road. An excess of dust made it necessary to treat the surface with calcium chloride. Photograph 12 shows this section.

EXPERIMENT NO. 13—TAROID.

Taroid is described by the manufacturers as being "a coal tar pitch prepared in liquidized form as a binder." The lower course, or base, for this section was shaped up with rather small size stone, filled and thoroughly rolled. The stone for the top course varied in size from 3½ inches to 1½ inches. This stone was spread to a depth of about 3 inches. The method of treatment was similar to section No. 3. From 1 to 1½ gallons of hot taroid was poured on each square yard of surface. This pouring was done by hand, 4-gallon galvanized pouring cans, equipped with fan-shaped nozzles, being used. After the taroid had partly cooled, the surface was well rolled. Coarse torpedo sand was then spread over the entire surface and the road was again rolled, which completed the treatment.

An excess of tar has resulted in "bleeding," both on the surface and at the sides of the roadway. The surface is not entirely smooth, by reason of the fact that the tar has not been forced to the surface uniformly, but has come out in such a way as to form small ridges or knobs on the surface. Photograph 13 shows this section.

SECTION XIV. PETROLITHIC PAVEMENT.
Ohio State Experimental Road.

EXPERIMENT NO. 14—PETROLITHIC PAVEMENT.

This process of road treatment was introduced by the Petrolithic Pavement Company, of Los Angeles, Cal., who incorporate a heavy asphaltic oil into the road material by means of various tools and devices, some of which are patented by the company. The tamping roller is an important factor in the construction of this type of roadway. It consists of a roller about 3 feet in diameter whose

surface is studded with iron teeth 9 inches in length and having an end area of about 4 square inches. The action of these teeth on the road material is said to approximate that of a flock of sheep, and to produce a tamping, puddling and kneading action which compacts the lower portion first and gradually works the material into so compact a mass that the teeth or feet of the roller will finally ride on the surface without penetrating or indenting the roadway. The old macadam roadway where this section was constructed was first broken up with a rooter pulled by a steam roller and the loosening completed by turning with a common road plow pulled by horses. The loose stone was then

During the summer following the construction of this road, the asphalt was forced to the surface to a degree that it became very objectionable and vehicles chose to travel at the side of the road rather than over the roadway. The highway department caused a course of screened gravel to be rolled into the road in an effort to make the road passable. At the present time, in spite of this treatment, the road is in wretched condition. It is so soft that it shows the imprint of a shoe heel when walking over the surface and the traction engine had cut in so deeply as to make even the imprint of the tires plainly marked. The road surface is spongy and deeply rutted, as will be noted from Photograph 14.

SECTION XV. LIMESTONE CONCRETE.
Ohio State Experimental Road.

smoothed with a heavy "A" harrow. The California liquid asphalt heated to a temperature of 200 deg. Fahrenheit was then applied by means of a Petrolithic Glover road oiler. Three applications of one gallon each per square yard were made. The mass was then mixed by means of the petrolithic road cultivator and tamped and compacted by means of the petrolithic rolling tamper. A road grader was used to crown and shape the roadway. After the work of tamping had been completed a small amount of limestone screening was applied and the surface was smoothed with a steam roller. A fourth application of the asphalt consisting of about one-half gallon per square yard was used, the surface covered with limestone screenings and again rolled.

EXPERIMENT NO. 15—LIMESTONE CONCRETE.

This section was constructed of concrete made of crushed limestone and Portland cement rolled in place with a steam roller. The foundation was prepared by grading and shaping the old macadam road to give it the cross-section desired for the surface of the finished work. It was well rolled before placing the concrete. The concrete was made in the proportion of 1 part cement, 3 parts screenings, ranging in size from ½ inch to dust, and 6 parts limestone from 1 to 3 inches in size. It was machine mixed. Water was used very sparingly on account of the impossibility of rolling wet concrete. It was difficult to secure a concrete mixer for this small amount of work, and the

SECTION XVI. GRAVEL CONCRETE.
Ohio State Experimental Road.

machine that was obtained was not of sufficient capacity to produce the quantity that would secure best results. Owing to the slowness of the work, the roller was obliged to work over such short spaces that in part of the work a wavy surface resulted. If the work had been done more rapidly a much better surface would have been secured. The concrete was uniformly 6 inches deep and had vertical joints across its width at several places.

This pavement, as is shown in Photograph 15, is cracked, and is rapidly wearing at points where the batches of concrete have been joined. It is, of course, hard and dustless.

EXPERIMENT NO. 16—GRAVEL CONCRETE.

This section was constructed as an experiment to determine the utility and economy of gravel concrete for construction of highways in localities where a good quality of bank gravel is found. The concrete used in this section was made from unscreened pit gravel and Portland cement in the proportion of one barrel of cement per cubic yard of concrete. The concrete, which was a wet mixture, was placed on the road 6 inches thick, and the surface was formed by dragging a template over it. This method of construction was used in order to secure a concrete at a low cost that would be uniform in quality from top to bottom, with a surface that would not be slippery. The principal objection to rich concrete for paving has been its slipperiness. This work was made without joints and is in reality a slab 6 inches thick, 16 feet wide and 400 feet long.

This section is in better condition than section 15, as will be noted from Photograph 16. Where expansion cracks have formed there is no evidence of widening. It seems to possess a greater hardness than the preceding section.

EXPERIMENT NO. 17—WATER-BOUND MACADAM.

This section was constructed in accordance with the specifications for water-bound macadam now in use by the State Highway Department. The road is built in two courses, the methods employed on the two courses being identical. The stone ranged in size from 3 inches to 1½ inches. The stone was first rolled dry until there is no longer any waving or creeping movement, and the voids are reduced to a minimum. Dry screenings varying in size from ½ inch to dust were then applied during the finishing process of dry rolling. When the voids were completely filled water was freely applied and the rolling continued until a wave of limestone grout appeared in front of the roller as it passed over the surface. After the surface has been treated in this manner it is allowed to dry out or set before traffic is permitted to pass over it.

This section is excellent macadam and is as hard and smooth as a floor, but it possesses the one common bad feature of macadam: it is very dusty.

Although the experiment has not progressed to a point where the merits of the different treatments may be accurately heavy traffic, carries all classes of of elimination going on which will doubtless indicate two or three of the sections as the best. At the present time it is impossible to draw an accurate conclusion. The experiment is practically ideal in the one particular that a road was chosen which, while it has only a moderately heavy traffic, carries all classes of country road traffic from the loaded farm wagon to the "joy riding" automobilist.

Methods of Distillation of Bituminous Road Materials.

Report of Committee to American Society for Testing Materials.

THE special committee on distillation of road materials of the American Society for Testing Materials made the following report at the recent convention of the society, W. H. Fulweiler being the chairman of the special committee and Logan Waller Page chairman of the general committee on standard tests for road materials:

Our work consisted in distilling three standard samples by four methods. The committee did not feel warranted from the work done so far in recommending the adoption of any of the methods used as a standard method, but felt that the close agreement by the three laboratories with the method using the 250 cc. Engler flask, which was tentatively proposed last year, warranted its serious consideration and further study as a possible standard.

The possibility of securing flasks of specified dimensions in this country, the slight effect of variations in size of flasks on the results, the shortness of time required and the general ease in operation of this method seemed very promising. The precise dimensions of the flask, such as bulb capacity, height of take-off, size of neck, etc., should be studied further.

The question of the thermometer seems exceedingly important, and while the thermometer specified last year has given satisfactory results, further study of this question is felt to be desirable. The committee, however, suggests changing from a nitrogen to a carbon dioxide filled thermometer.

The calibration of the thermometer was not specified before, and the best method at present appears to be to calibrate the thermometer with the immersion and position in which it is to be used. The thermometer is tested, using water-naphthalene and dimethylamine, and by referring to a standard thermometer. For check calibration the ice and steam points alone are necessary, since any change in the calibration seems to apply linearly throughout the scale.

The committee suggests checking after every third analysis for new thermometers until they become seasoned.

With the three samples examined considerable decomposition was apparent above 300 degrees C., and it is felt that no accurate results are possible under such circumstances, and it therefore suggests stopping the distillation at 300 degrees C.

Many crude, and occasionally some refined materials are found to contain water, which seriously affects the accuracy of the first fractions in a distillation. No easy method of dehydration seems possible, so that the committee suggests distilling 500 cc. of the wet material in a copper still provided with a ring burner and a water cooled condenser, and collecting the distillate in a 200 cc. separatory funnel with the tube cutoff close to the stopcock. When all the water has been driven over and the distillate has settled out, the water is drawn off and the oils are returned to the still contents after they have been cooled below 100 degrees C. The distillate should be thoroughly stirred into the residue.

The committee wish to call attention to the fact that some materials have a tendency to stratify on standing, and suggest that all samples be carefully and thoroughly stirred before taking a portion for analysis.

The committee would suggest that the determination of the specific gravity of bitumens is not as simple as it appears, and believes that a standard method should be recommended by the society.

Embodying the above points, the committee suggests the following tentative method for the distillation of bituminous materials suitable for road treatment.

SUGGESTED TENTATIVE METHOD FOR THE DISTILLATION OF BITUMINOUS MATERIALS SUITABLE FOR ROAD TREATMENT.

Sampling: The sample as received should be thoroughly stirred and agitated, warming, if necessary, to insure a complete mixture before the portion for analysis is removed.

Dehydration: If the presence of water is suspected, or known, the material must be dehydrated before distillation. About 500 cc. is placed in a copper still of 800 cc. capacity provided with a distilling head connected with a water cooled condenser. A ring burner is used, starting with a small flame at the top of the still, and gradually lowering it, if necessary, until all the water has been driven off. The distillate is collected in a 200 cc. separatory funnel with the tube cutoff close to the stopcock. When the water is all over and the distillate has settled out, the water is drawn off and the oils returned to the residue in the still. The contents of the still should have cooled to below 100 deg. C. before the oils are returned, and they should be well stirred and mixed with the residue.

Apparatus: The apparatus shall consist of the following standard parts:

1. Flask. The distillation flask shall be a 250 cc. Engler distilling flask, having the following dimensions:

Diam. of bulb	8.0 cm.
Length of neck	15.0 cm.
Diam. of neck	1.7 cm.
Surface of material to lower side of tubulature	11.0 cm.
Length of tubulature	15.0 cm.
Diam. of tubulature	0.9 cm.
Angle of tubulature	75 degrees

A variation of 3 per cent. from the above measurements will be allowed.

2. Thermometer. The thermometer shall be of hardened glass, filled with carbon dioxide under pressure and provided with an expansion chamber at the top; it shall read to 450 deg. C., and shall be graduated in single degrees Centigrade, and shall have the following dimensions:

Diam. of stem	6.75 to 7.25 mm.
Length of thermom.	335 to 350 mm.
Length from 0 deg. to 450 deg. marks	285 to 300 mm.
Length of bulb	20 to 22 mm.
Diam. of bulb	5.25 to 6.50 mm.

It shall rise from 15 deg. to 95 deg. in not less than 3 seconds nor more than 5 seconds when plunged into boiling water.

The thermometer shall be set up as for the distillation test, using water, naphthalene and dimethylamine as distilling liquids. The correctness of the thermometer shall be checked at 0 deg. C. and 100 deg. C. after each third distillation until seasoned.

3. Condenser. The condenser tube shall have the following dimensions:

Length of tube	500 mm.
Width of tube	12 to 15 mm.
Width of adaptor end of tube	20 to 25 mm.

4. Stands. Two iron stands provided, respectively, with one universal clamp for holding the condenser, and one light grip arm with cork-lined clamp for holding the flask.

5. Burner and Shield. Bunsen burner with tin shield 20 cm. long by 9.0 cm. diameter. The shield has a slight hole for observing the flame.

6. Cylinders. The cylinders used in collecting the distillate shall have a capacity of 25 cc., and shall be graduated in tenths of a cubic centimeter.

Setting Up the Apparatus: The apparatus is set up as shown in Table 7, the thermometer being placed so that the top of the bulb is opposite the middle of the tubulature. All connections should be tight.

Method: 100 cubic centimeters of the dehydrated material to be tested is placed in a tared flask and weighed. After adjusting the thermometer, shield, condenser, etc., the distillation is commenced, the rate being so regulated that 1 cc. passes over every minute. The receiver is changed as the mercury column just passes the fractionating point. The following fractions should be reported:

Start of distillation.
Up to 110 deg. C.
110 deg. C. to 170 deg. C.
170 to 235.
235 to 270.
270 to 300.
Residue.

To determine the amount of residue the flask is weighed again when distillation is complete. During the distillation the condenser tube shall be warmed when necessary to prevent the deposition of any sublimate. The percentages of fractions should be reported both by weight and by volume.

W. H. Fulweiler.
Chairman of Special Committee on Distillation.

Respectfully submitted on behalf of the committee.

L. W. Page, Chairman.
Prevost Hubbard, Secretary.

COMPARISON OF THERMOMETER SPECIFICATIONS.

	Office of Public Roads.	Barrett Mfg. Co.	United Gas Improvement Co.
Filled under pressure	Yes, nitrogen	Yes, nitrogen	Yes, nitrogen
Expansion chamber	Yes, at top	Yes, at top	Yes, at top
Graduated	400 deg. C. in deg.	400 deg. C. in deg.	450 deg. C. in deg.
Accuracy, required	¼ deg. C.	¼ deg. C.	¼ deg. C.
Immersion		3 in.	
Total length	430 mm.	370 mm.	335 mm.—350 mm.
Diameter of stem	7.2—7.4 mm.	7.8 mm.	6.75—7.25 mm.
Scale length	—23 deg. to 400 deg., 363.5 mm.	0 to 400 deg., 267 mm.	0 to 450 deg., 285—300 mm.
Length of bulb	30.2 mm.	11.1 mm.	20—22 mm.
Diameter of bulb	6.7—5.7 mm.	6.35 mm.	5.25—6.50 mm.
Sensibility	15 deg.—90 deg. in from 3 sec.—6 sec.	80 deg. in from 3 sec.—5 sec.	15 deg.—95 deg. in from 3 sec.—5 sec.

Sewage Disposal with Respect to Offensive Odors.

By George W. Fuller, M. Am. Soc. C. E., New York City.

Removal of Suspended Matter and Disposal of Sludge.

TAKING everything into account, it may be said that the treatment that is most suitable and available to-day to secure the requirements of disposal of sludge with minimum opportunity for objectionable odors is that of the two-story tank, in which sedimentation occurs in the upper chamber and the digestion of the sludge in the lower compartment, with no connection between the two for transmitting gases or other products from the lower to the upper. In the opinion of the writer it constitutes the greatest step in advance that has been taken in the field of sewage disposal during the past five yeaers. This opinion is given with full appreciation of the fact that the process is one that requires careful management and that there is a large amount of work to be done by the chemist and bacteriologist in adapting it so as to work to best advantage under a wide range of differing local conditions.

This process, like practically all others, is not a cure-all for various conditions without careful management. There is no reason to believe that sludge digestion by this process does not involve sulphureted hydrogen and all other malodorous products. Available data clearly indicate that these products are formed. The problem is to control them as well as or better than they have been controlled in the several score of plants that have worked so well in the Emscher district in Germany. In some measure the Emscher results have been associated in the minds of some with iron compounds which precipitate sulphureted hydrogen and which may perhaps have much to do with the texture and condition of the sludge, as regards its rate of drying on strainers of coarse sand or gravel. It also may be that the mixing which occurs in the digestion chamber, due to gas ebullition, may be of much benefit, and that this may be controlled under some circumstances to advantage by artificial mixing with aid of water introduced under pressure, as has been done in some instances in the Emscher district.

There is no reason why the artificial application of iron salts should not be availed of in well-managed plants, if needed. With this done, a large share of the difficulties encountered in some plants could be overcome as regards the objectionable odors encountered from time to time.

Filtration Processes.

When a sewage has been well clarified under such conditions that it has been kept as fresh as possible—that is, with bacterial decomposition on an oxidizing and not on a reducing basis—and where the sludge has been taken care of in an inodorous way, it is not a difficult matter to filter the sewage by one of several different methods, so as to secure a non-putrescible effluent of good appearance, without objectionable odors. Reference will be made briefly to these filtration methods, as follows:

Intermittent Sand Filtration.—This method, which has been used generally in New England, is a satisfactory one for small or moderate sized plants, where the filter beds may be economically established. This means usually that their applicability depends much upon finding deposits of porous sand conveniently accessible. When such sand deposits are not readily available, as is true outside of the glacial drift formation, coarse-grained filters are generally more applicable. The intermittent filters will give an excellent effluent, and where the surfaces are not allowed to become clogged there will be no objectionable odors, although there are, of course, noticeable odors immediately at the beds. Objectionable odors are coincident with clogged surfaces, particularly where the filter material is fine and where the sewage stands for some time so that it actually putrefies upon the filter bed. One of the reasons why, in the northern climates, intermittent filters so seldom produce a nuisance as to smell is that they carry their load much more readily during the summer than during the winter months. In other words, rates of filtration which can be availed of during the winter, when decomposition takes place slowly at low temperatures and when it is impossible to clean the filter surfaces for weeks at a time, seldom give trouble in the summer, when frost and snow are absent, but when bacterial decomposition is most active. With fairly porous material and with unsettled sewage, good results should follow the use of this method, where the sewage of not more than 600 people per acre is applied. For short periods unsettled sewage in larger quantities may be applied, particularly if the material is fairly coarse. It is not wise to figure permanently upon such large doses that clogging arises to a degree that makes its removal too fre-

quent and expensive. Where sewage has been clarified or passed through stone filters, rates of filtration much in excess of those above indicated may be safely used, but it is difficult to state just what the limit should be for varying local conditions. The load certainly should not be such as to cause putrefaction to develop, with its attendant bad odors.

Contact Filters.—These filters will operate satisfactorily in beds of a depth of about four feet, when receiving sewage after some clarification at the rate of about 600,000 gallons per acre daily. Where the material is fairly fine it does not seem feasible to increase this rate much with clarified sewage. The reason of it is that during such a large portion of the time the beds have no air in their pores. The rates probably could be increased by keeping the applied sewage fresh and by using coarse stone that drains quickly, and also by commencing drainage operations a short time after the pores of the material are filled. One of the great steps in advance recently in the design of this style of filter is to fill them from below to within a few inches of the surface. Thus the sewage does not appear while it is in a putrescible condition. This method also has the advantage of eliminating surface clogging and the necessity of scraping off deposits of scum which have bad odors under some circumstances. The underfed beds, however, should be provided with a false bottom beneath the filter material, and should be drained at a velocity which will flush out solid matters which appear on the filter floor. This means that this style of filter possesses to a considerable extent the unloading feature of sprinkling filters. Under ordinary circumstances it calls for a final settling basin in which the coarse deposits are removed before the final effluent enters a small stream or is applied to a high-rate sand filter.

Sprinkling Filters.—When the applied sewage is fresh, as is the case at Reading, Pa., where dissolved oxygen is almost never absent in the sewage that reaches the filter plant, this style of filter rarely gives odors that are noticeable 200 feet away. On the other hand, if the applied liquid is in a putrefying condition, the sprinkling of the influent releases the various malodorous products, particularly the sulphur compounds, and at the same time there is a smaller percentage of saturation of atmospheric oxygen in the liquid as it reaches the surface of the filter. Filters of this type, 6 feet deep, will ordinarily dispose satisfactorily of the sewage of some 20,000 to 25,000 people per acre. This is predicated on the conditions being such that the atmospheric oxygen is present at all times and at all places within the pores of the filter bed. The filtering material should not be too fine, as otherwise there is danger at intervals of surface clogging, due either to suspended matter in the sewage or to filamentous vegetable growths, or both. With reference to the size of the material, that most generally preferred is either from 1 to 2 inches in average size or from 1½ to 2½ inches. The use of hypochlorite of lime for destroying vegetable growth and in promoting the self-cleansing of the filter bed as desired, according to Mr. S. S. Chase, of Reading, makes moderately fine material safer than it was generally considered to be a few years ago. Artificial aeration of stone beds such as was studied years ago at Lawrence and Newport has again been studied in Europe, with the conclusion that it is of benefit. It is not believed by the writer that this is correct in principle, unless it provides oxygen at some place where it would otherwise be lacking at times. Ventilators are so inexpensive, however, that exception can scarcely be made to their trial.

STERILIZATION PROCESSES.

Where sewage is discharged into drinking water streams or bodies of water from which shell fish are obtained, it is possible and sometimes advisable to destroy at moderate cost the vast majority of disease producing germs in the sewage by applying strong oxidizing chemicals such as hypochlorite of lime or soda. This treatment scarcely provides absolute sterilization as it is obviously out of the question at moderate cost to destroy by oxidation the thick walled spores or even the vegetative bacterial cells that are encased in particles of suspended matter. It is feasible, however, to destroy more than 99 per cent. of the vegetative cells which respond to ordinary laboratory methods of enumeration.

Several investigators have noted that when sewages or sewage effluents are treated with a sterilizing chemical the liquid will not putrefy for some time. This is explained in a large measure by the death of bacteria which are capable of decomposing the sewage and thus setting up putrefaction after available oxygen is exhausted. Even when such samples are mixed with surface waters of good quality a comparatively long period may elapse before they putrefy. This may be explained in part by an excess of the sterilizing chemical which may destroy the bacteria of the water which is mixed with the treated sewage or sewage effluent. It may also be explained in part by the failure of the diluting water to contain bacteria which readily bring about a reducing fermentation or putrefaction.

It is not to be inferred, however, that

sterilized sewage may be discharged with impunity into small water-courses particularly if there is considerable suspended matter in the treated product. It would be only a question of time before the suspended matter would deposit and form sludge banks in which bacterial putrefaction would become established. It is also probable that sterilized sewages or sewage effluents regardless of the suspended matter would sooner or later putrefy in their flow in water courses by mingling with the surface waters containing bacterial flora that would set up putrefaction.

Reflection upon the comments above made will be of assistance in understanding the practical application of bacterial processes of oxidation and putrefaction in that they show that it is necessary to have time, bacteria and oxygen to bring about an oxidizing fermentation; and, further, that it is necessary to have the right kinds of bacteria, the necessary amount of time and absence of oxygen to bring about putrefaction. Sewage will not putrefy if all three factors are not provided and this also explains why oxidation even of crude sewage will continue for an abnormal period when the oxygen is increased by aeration and thus postpone the time when putrefaction arises.

RESUME.

The purpose of this paper is largely to outline the writer's present understanding of the scientific status of oxidation and reduction as these products occur in sewage treatment. This has been done, partly with a view to promoting appreciation of the subject by those who are not specialists in this field and partly to indicate where more data are desired.

As to the practical art of sewage disposal the methods now available permit much more satisfactory results to be obtained than was the case a few years ago. Those causes, which from time to time in exceptional cases have resulted in unsatisfactory conditions, with objectionable odors now and then noticeable at some distance from the disposal plant, are now quite well understood. Consequently, there should be in the future far less opportunity than at present to cite instances where modern sewage disposal works with good management fail to eliminate nuisances but tend to create them.

What is the Best Street Pavement?

By J. C. Travilla, Street Commissioner, St. Louis, Mo.

IN St. Louis the street commissioner has under his supervision the platting, improving, cleaning, sprinkling and maintenance of the streets, avenues, boulevards and roads.

The highways of the city are generally acquired by dedication. The owners, in subdividing their property into blocks and lots, open up streets and alleys. In the subdivision each owner is desirous of obtaining a maximum number of front feet for his property, without due consideration of the alignment and width of the streets. In most of our cities this method of acquiring highways has brought about a very unsatisfactory condition of affairs. Commissions are being authorized for the replanning of a number of cities, and city officials are endeavoring to secure legislation prohibiting the platting and recording of property without previous approval of the same by some agent of the city. Following the subdivision of property with the growth, expansion and public necessities of a city, highways are eventually converted into improved city streets; therefore, while the mileage of finished streets increases yearly, the extent of the work remaining to be done is not greatly diminished.

Expressing the work of the St. Louis street department in money values there is appropriated annually for cleaning, sprinkling and repairing 930 miles of streets and boulevards $1,318,000. In addition there is paid annually to contractors by property owners $2,500,000 for the improvement of streets, boulevards and alleys. For street and boulevard paving all of the standard materials are used, to-wit: asphalt, bitulithic, creosoted wood block, vitrified brick, granite block and macadam.

I am frequently asked: "What is the best paving material for city streets and boulevards?" This question cannot be readily answered, as the particular material that should be selected depends upon the character of the traffic, street grades, realty values and other elements. Each class has its proper place, but the first cost per square yard determines for the average taxpayer his choice of a paving material. Different kinds of paving material rise and fall in public estimation, due to various causes, the verdict resulting sometimes from inferior workmanship and material and as often from the condition of the pavement under varying degrees of temperature, dryness, cleanli-

ness, noise, traction and the lack of judgment of the taxpayer or highway commissioner in its selection.

The ideal pavement should be elastic, smooth, noiseless and stand up a reasonable or economic length of time under the traffic conditions to which it is subjected. By comparison with other materials, granite block seems to be the only paving material that will last indefinitely. Each class of paving material deserves special mention in a discussion of this kind.

The asphalt and bitulithic pavements consist of mineral matter held together by a bituminous material. The success of either depends upon the character of the bitumen, mineral matter, the grading of the latter, the manipulation of the material at the plant and its proper handling on the street. Satisfactory results may be obtained with both materials if traffic conditions be given due consideration in the choice and specification of materials and method.

These paving materials are especially adapted to residential streets and boulevards, free from street car tracks, and where heavy hauling is not excessive. On narrow streets with car tracks traffic is confined to the space between the outer rail and the curb line, and if not sufficiently distributed, the wagon tires invariably form a groove in the pavement. Paving the space between the street car rails with these materials is not recommended.

Wood block has been recognized as a paving material for many years. Because of insufficient impregnation with the preserving material and therefore lack of waterproofing, the first pavements of this class were not a success. The modern wood block pavement, where the blocks have been impregnated with creosote oil and coal tar, gives every indication of being the best paving material. The waterproofing of the blocks by means of a heavy oil seems more essential than the character of the preservative used. The life of this type of pavement has been a surprise to engineers and taxpayers.

Various kinds of timber are well suited for paving blocks. My experience, however, has been limited to the use of southern long-leaf yellow pine and tamarack, both of which have been equally satisfactory. The amount of oil used per cubic foot has been varied from twelve to twenty pounds.

This pavement is well suited to high-grade residential streets and boulevards and for streets in the retail business districts, where there is much mixed traffic and a demand on the part of the merchants for a noiseless pavement. Its objectionable feature is its smoothness, causing it to become slippery under certain weather conditions. This may be overcome, however, by the use of sand. It has been the practice of the department here to use oiled sand. The oiled sand is applied late in the fall and in the early spring. By the use of oil the sand is held in place on the surface of the pavement—not blown to the curb line. Comparatively speaking, wood block is a high-priced pavement.

Vitrified brick is very largely used for paving. The brick may be readily obtained, are easily laid by unskilled labor and its use offers opportunity for much competition. Its objectionable features are noisiness, chipping of edges, lack of elasticity and, where a stiff grout has been used as a filler, the expense for repairs and maintenance. A grouted brick pavement with very little traffic if laid late in the fall or early spring is apt to disintegrate in spots, due to expansion, if sufficient provision to accommodate this has not been made by use of transverse as well as longitudinal expansion joints. It is our practice to place transverse expansion joints every hundred feet or oftener. The use of brick should be limited to streets having car tracks and on the less important residential streets.

Granite blocks alone meet traffic conditions in the railroad and warehouse districts.

The use of macadam is well adapted to city streets where property values are low and where there is a demand for a temporary paving, pending the construction of sewers, the laying of water mains, etc., and on boulevards and roads carrying light traffic.

Without a firm foundation all of the paving materials named will prove failures. For the hard pavements a base of from five to six inches of Portland cement concrete in the proportion of 1-3½-7 has been found adequate.

The maintenance of a bituminous pavement for a period of five years from the date of its completion usually devolves upon the contractor. This period of time has been fixed by city officials because of their lack of knowledge of the resistance to traffic and temperature changes of bituminous materials.

With standard specifications and laboratory facilities this guarantee will, in time, be reduced to a much shorter period. The guarantee contracts are a source of trouble to the commissioner. since the contractor tends to suit his own convenience in starting repairs. Usually he is inclined to wait until some service corporation cuts are to be repaired in the vicinity of the maintenance work. In my opinion, a city should have proper equipment for every branch of street repairs and maintenance.

Street excavations if not properly regu-

lated are detrimental to the life of the pavement. It is the practice here to have an inspector on the work when the trenches are refilled to see that the earth is properly tamped up to the bottom of the concrete. The trench is then filled with sand to within four inches of the surface of the pavement, vitrified brick being laid in the cut, flush with the pavement. This sand is eventually used when the excavation is ready for concreting.

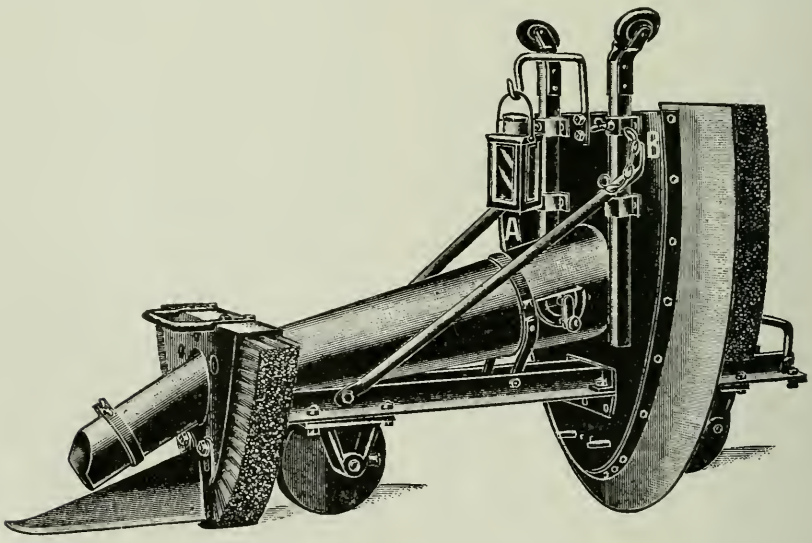
City streets and boulevards would not present a pleasing appearance if they were not regularly cleaned. This division of work not only adds much to the comfort of the people, but acts as an advertisement for the city and its administration. Good results depend largely upon the efficiency of the organization and a sufficient appropriation to properly carry on the work.

The sprinkling of city streets and boulevards with water is difficult to regulate. The number of times a pavement should be sprinkled per day depends upon the season of the year, the character of the pavement and traffic conditions. In St. Louis the work is done under contract and costs from $450 to $500 per mile per annum. At the present time we have more than 500 miles of streets included in this contract, the average cost per annum to the property-holder being about four cents per front foot.

Sewer Scrubber and Scraper.

By Dr. Robert Grimshaw, Dresden, Germany.

THE apparatus here illustrated, and which is in use in several German cities, and was exhibited in the Dresden Hygiene Exposition, is designed to effect a thorough scrubbing and scraping of the sewer walls. It is introduced into the sewer at any convenient shaft, a part of the apparatus being temporarily removed for this purpose. This removal and the subsequent replacement are facilitated by the use of pins and cotters. The oval-edged scraper folds above its main axis; it is furnished with an India-rubber "squeegee" edge, readjustable to the width of the canal after wear, and a profile brush reaching to the short axis of the sewer's cross-section. The pilot of the device is formed by a stiff, coarse profile brush extending about half way up to the short diameter of the sewer oval. A guide wheel on the under side and two guide wheels above, vertically adjustable in height, hold the device square across the sewer and insure that the squeegee packing fits well all around. The scraper dams up the sewage until it has reached a certain height; then a butterfly valve in the dam or cross-wall is opened and the apparatus is automatically set in motion, being driven by the



force of the water behind it. The plow in front stirs up the mud deposit and the dammed-up water from the cross-wall flushes it out.

Tests in Ludwigshafen on the Rhine, on a reach of 620 meters, or 2,034 feet, of sewer, with a cross-section of 70x105 centimeters—27.6x41.4 inches—gave the comparative costs of cleaning by hand and by this apparatus, as follows:

Hand—
3 men 12 days at M. 5.....M. 180
Removing the deposits.....M. 35

Total .....M. 215

Apparatus—
3 men 2 days at M. 5.....M. 30
Removing the deposits.....

Total .....M. 30

This figures up for hand work 34 pfennigs per meter; by the machine, only 4.8 pfennigs, not counting interest, depreciation and upkeep. Reckoning for these 15 per cent. of the original cost, we have only 6 pfennigs as against 34 for the hand system.

In Dortmund, for a sewer 165x195 centimeters—65x77 inches—the following data are given:

	Length		Wages, Mks.	Removal of Deposits	Total Cost	Cost per Meter length
	Meters	Feet				
Hand	355	1165	812	M. 493.50	M. 1305.50	M. 3.67
Hand	127	417	379.40	M. 87.50	M. 466.90	M. 3.67
Mach.	787	2582	575.40	M. 70	M. 645.40	M. 0.82

In this latter test the apparatus had to contend with an uneven sewer bottom, there being places where the level had fallen 30 inches by reason of mining operations.

The apparatus is exhibited by Haase & Co., of Gotha. For an oval sewer 36x54 inches in cross-section the weight is about 330 pounds.

A mark is 24.8 cents in value, or the costs in dollars are practically one-fourth the costs given in marks.

The Pollution of Streams by Manufacturing Waste.*

By William S. Johnson, C. E., New York City

WILLIAM S. JOHNSON, Tech. '89, sanitary and hydraulic engineer of Boston, discussed the growing tendency on the part of the public to resist all pollution of streams, and the measures open to the manufacturers in dealing with this part of the problem. Mr. Johnson said in part:

In the case of streams the public is beginning to demand something more than protection to health. It requires that the stream shall become, as they will if kept clean, the most attractive features of the neighborhood. It is at the same time becoming better understood that it is possible to have clean streams, even in a region devoted to manufacturing, and that the expense of securing this condition is not such as to drive the manufacturer from the district. In fact, this movement for clean streams is so wide-spread that the manufacturer would have difficulty in finding a location where he would feel certain that this demand will not arise, either now or in the near future.

It is certain that this public demand, enforced as it has already been by the legislatures and the courts, and the demand of the manufacturers themselves who require clean water in the manufacturing processes, will result in the necessity of keeping out of many of our streams the most objectionable of the manufacturing wastes, and this has become one of the serious problems to be met by the manufacturer.

The simplest solution of this problem, so far as the manufacturer is concerned, is to make, where possible, a connection with the public sewers, transferring the problem of the disposal of the wastes to the public authorities; but this method of disposal is, in many cases, impossible and its feasibility in other cases questionable.

In this country the tendency is rather to prevent the discharge of any considerable quantity of untreated manufacturing wastes into the sewers and to oblige the manufacturer to construct independent works, or at least to treat the wastes so that they will not cause trouble in the sewers or at the disposal works.

The quantity of liquid wastes produced at a single factory is frequently greater

*From a paper before the Congress of the Massachusetts Institute of Technology.

than the total quantity of domestic sewage flowing in the sewers of the town in which the factory is located, and the character of the wastes may be such that they cannot be purified in connection with the sewage, except at a very great increase in the cost. The cost of the sewers and of sewage disposal is largely assessed upon those benefiting by the sewers and in proportion to the benefits received. If a proper portion of the cost should be assessed on the manufacturers the assessment would be in many cases enormous and enough to make such disposal practically prohibitive.

Some wastes can undoubtedly be discharged into the sewers without causing trouble, depending on the character of the wastes and their volume as compared with the volume of domestic sewage flowing in the sewers. Other wastes can be discharged into the sewers after some simple preliminary treatment without causing trouble; but in perhaps the majority of cases, where wastes cause trouble in the stream, they are likely to cause trouble in the sewerage system, especially if the sewage is purified.

Manufacturing wastes vary very greatly in their composition and generally have quite different characteristics from domestic sewage. In some cases the wastes are very much more readily disposed of by dilution than is domestic sewage, while in other cases the effect of dilution is very much less. No fixed rule can be applied to the amount of manufacturing wastes of any given kind which can be discharged into a stream of given volume, for the seriousness of the pollution depends on the use to which the water is put even more in the case of manufacturing wastes than in the case of domestic sewage.

The Combined Water Works, Electric Light and Ice Plant at Loveland, Ohio.

By Frank C. Perkins, Buffalo, N. Y.

THE many advantages to be gained by combining in a single installation an electric light plant, water works and ice-making equipment are clearly shown by the accompanying illustrations and the following data of such a combination at Loveland, a town of several thousand inhabitants near Cincinnati, Ohio. This town is located on the Little Miami river, and the three systems of ice-making, water works and electric light and power distribution are operated by a single office force of the Loveland Citizens' Electric Company.

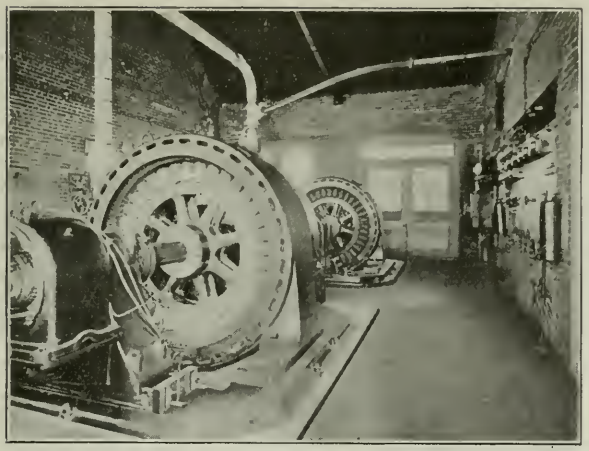
The installation for making ice consists of a compressor room freezing tank, storage tank room and flat cooler, with ice dump, from which the wagons are loaded, the ice being passed through a chute to the wagon platform or into the ice storage room. Over the latter there are fruit storage rooms as well as egg and meat storage rooms, while under the ice storage room is another space for cold storage purposes.

The engine room of the power plant is seen in the accompanying illustration, Fig. 1, equipped with two direct-connected engine generators of 125 k.w. capacity, and the switchboard seen at the right. One of these engine-generator sets is seen in Fig. 2, the four-valve engine being seen in the background, and it is maintained that with this unit it has been possible to attain an efficiency of 90 per cent. from the indicated horse power on the engine to the switchboard on two-thirds load.

The arrangement of the switchboard is neat and compact, all wiring and mechanism possible being placed at the rear of the board, which includes five panels. Beginning at the left the first two machine panels are utilized for the two engine generator sets, the third power panel supplying current for the motors throughout the city, the next panel being employed for the distribution of commercial incandescent lighting in East and West Loveland, while the fifth panel takes care of the street light system, divided into two circuits, for East and West Loveland.

The accompanying illustration, Fig. 3, shows the high duty cross-compound crank, flywheel, engine and pump and the duplex steam water pump, which is used as a duplicate equipment. Under these pumps there is a large cement container which holds about 45,000 gallons of water, into which a vertical centrifugal motor-driven pump, at a driven well on an island 2,600 feet from the power plant, is used to deliver the water. From this container the water is distributed under pressure to the city service.

The water is pumped from the cement container under a pressure of from 110 to 120 pounds per square inch, to a tank located a quarter of a mile from the



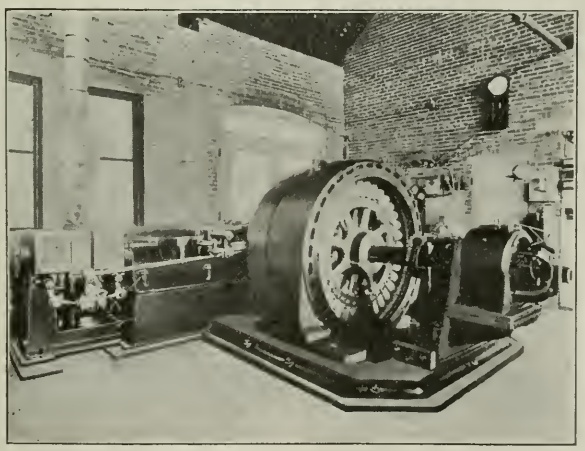
LOVELAND WATER WORKS, ELECTRIC LIGHT AND ICE PLANT.
1. Engine Room.

water works, this tank supplying the town having a capacity of 120,000 gallons.

The steam is supplied for operating this power station by two water tube boilers of 200-horse-power each, the feed water being supplied by two duplex pumps interconnected for supplying either of the two boilers in the boiler room. An elevator conveys the fuel to the storage room as it is dumped from the cars into a track hopper, the cost of unloading the fuel being very low. An accurate record is kept of the fuel consumed, the coal being weighed as delivered to the boilers by a special automatic weighing device, while the water is measured in the settling basin, the amount of water evaporated per pound of coal being accurately determined.

In the electric plant the two four-valve engines are directly coupled to three-phase alternators supplying a current of 2,200 volts with a frequency of 60 cycles per second. It will be noted from the illustration that the exciters are directly coupled to the extended shaft of the alternator, the arrangements being such that the bearings can always be adjusted to the shaft for maintaining perfect alignment.

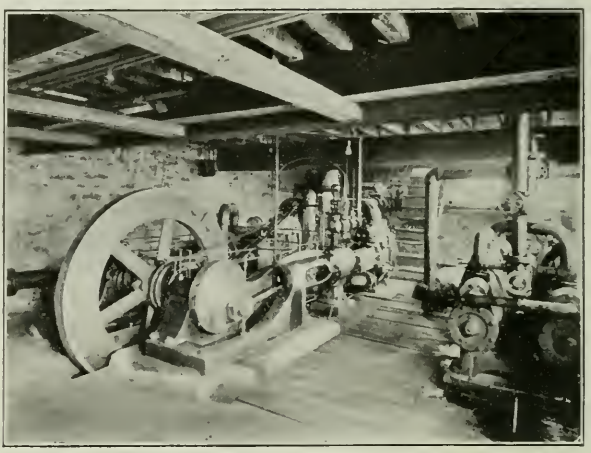
A remarkable fact is recorded that in this small town of Loveland every steam engine user has found it desirable and economical to install electric motors, the



LOVELAND WATER WORKS, ELECTRIC LIGHT AND ICE PLANT.
2. Engine-Generator Set.

engines being discarded, with a profit to the electric plant and a decided saving to the consumer as well.

By this combination of electric lighting, water pumping and ice making, it has been found possible by the management to give electric service day and night at moderate rates, the efficiency of the electric light plant being greatly increased, the power being utilized during light loads for ice making and pumping service to the city water storage tanks.



LOVELAND WATER WORKS, ELECTRIC LIGHT AND ICE PLANT.
3. Pumping Engines.

Term of Lease for Boston Subways.

AT the present time in Boston and New York the future transportation problem is before the public and the city. In Boston the discussion is centered more on the period of lease than on any proposed extensions, and the report of the Committee on Public Utilities, of which Mr. Dugald C. Jackson is acting chairman, to the Chamber of Commerce, distinctly shows that the committee believes a 25-year lease can be worked out on a fair basis.

The committee is unanimously of the opinion that it would not be in the public interest to give an option at the present time for the extension of the leases beyond 1936, with the possible exception indicated below. The advance in the methods of transportation during the past twenty-five years, and the increase in the number of passengers transported resulting therefrom, have been tremendous. What changes will take place within the next twenty-five years, and what the conditions will be at the end of that period, no man will undertake to say; and it seems a sacrifice of a most important power of determination to deprive the next generation of the opportunity to avail themselves of such improved methods of transportation and such desirable changes and additions to their transportation facilities as may at that time seem wise—the nature, extent, and importance of which cannot now be foreseen—and to decide for them, in advance of any knowledge, the conditions under which these subways, which may very likely always be the central and controlling factor in the transportation facilities of the city, shall be occupied and utilized. They are entitled to such transportation facilities as may at that time seem to them essential, and the cost of which they are willing to pay. What transportation facilities will be at that time essential, and the conditions under which it will then be fair to ask the Transportation Company to provide those facilities, are not at this time known.

It has been urged that the additional subways which the leases cover will not during the first few years of their operation bring in sufficient additional revenue to pay the rental thereof, at the rate fixed in the pending act, and that it is not fair to the company, and not in the interest of the public to ask the company to take a

25-year lease of them upon terms which would be fair for a 50-year lease.

It is obviously true that conditions which would be just and fair under a 50-year lease, and which would enable the company to finance its needs on favorable terms, may very well be unjust to the company and not in the interest of the public if the term is to be 25 years; but the committee points out that neither the company nor any public body or board has yet undertaken to say what terms and conditions of relief from other terms and conditions would be fair for the company if the term of the leases is to be 25 years. It is believed that if a vigorous, determined and intelligent effort is made to do this, a fair basis for 25-year leases can be worked out.

The committee unanimously recommends that at least until this is done and the public has had the question clearly presented for its consideration as to whether it prefers 25-year leases with whatever concessions by it may necessarily and properly accompany them, or the longer term leases with the disadvantages accompanying them, the Chamber oppose the passage of any act providing for the leasing of the existing and prospective subways for the longer period.

A Theoretical Formula for the Curve Resistance to the Flow of Liquids.*

By Philip J. Markmann, C, E,, St. Louis, Mo.

THE resistance offered by bends in pipes or curves in open channels to the flow of liquids is a much-mooted subject in hydraulics.

We find empirical formulae for the loss of head due to bends in pipes by Du Buat, Navier, Weisbach and probably others.

These formulae, being empirical ones, probably cover the range of the respective experiments with regard to velocities, kinds, size and curvature of pipes under observation.

One of the contributions within recent years, in the line of experimental data, is the paper of Williams, Hubbell and Fenkell, of Detroit, entitled "Experiments at Detroit, Michigan, on the Effects of Curvature upon the Flow of Water in Pipes," published in the Transactions of the A. S. C. E. of April, 1902, vol. xlvii.

In the introduction to their paper they made this statement: "Having satisfied themselves that there were no data extant that an engineer was warranted in applying to the cases occurring in ordinary practice, nothwithstanding the unanimity of opinion expressed in hydraulic treatises, the writers have considered it unnecessary to present any resume of meager data supposed to bear upon the question in hand." etc.

This in itself is a rather remarkable statement of the status of hydraulic knowledge, and becomes rather sensational when supplemented by the authors' conclusions, on the basis of their own experiments, which are:

"The experiments taken as a whole prove beyond question or doubt that the hitherto accepted notions of the laws governing curve resistance are wholly in error.

"Curves of short radius, down to a limit of about 2½ diameters, offer less resistance to the flow of water than do those of longer radius, and hence the theories and practices regarding curve resistance, as set forth in the hydraulic treatises of all nations up to the present time, are absolutely incorrect and the diametric opposite of the true conditions."

Later on, when summing up the discussion and the criticism on their paper, these authors found themselves compelled to modify their above statement, as follows:

"In a given length of pipe, consisting of two tangents joined by a curve of 90 degrees, the loss of head will decrease as the radius of the curve is decreased, to a limit of about 2½ diameters, and will increase as the radius is increased above that limit, the total length remaining the same."

They insist, however, on the originality of their statement, that "the theories and practices regarding curve resistance, as set forth in the hydraulic treatises of all nations up to the present time, are absolutely incorrect and the diametric opposite of the true conditions," by saying: "An examination of the various treatises on hydraulics, contained in one of the most complete libraries in America, made before this paper was written, failed to show in Italian, Spanish, French, German, English, Canadian or American hydraulic textbook or manual a single statement to indicate that curve resistance

*A paper before the St. Louis Engineers' Club.

ever decreased with the radius, and likewise failed to show one in which it was not either directly stated or clearly intimated that long, easy curves offer less resistance to the flow of water than those of shorter radius."

We readily believe, without this emphatic statement, that such is the fact, because we cannot stultify ourselves by ever accepting Williams, Hubbell and Fenkell's conclusion to the contrary as true. Not one of the numerous contributors to the discussion intimated that the doctrine of Williams, Hubbell and Fenkell was not a new one to them.

Some time later, in 1906 and 1907, "Experiments by Brightmore on Curves in Four-Inch and Three-Inch Pipes" was published in Proc. Inst. C. E., of Great Britain. This investigator is the first one, apparently, who states that the excess loss depends, not only upon the radius, but also on the velocity.

Still later we have "Experiments by Schoder on Curve Resistance in Water Pipes, Six and Eight-Inch Diameters," published in the Transactions, A. S. C. E., 1909, vol. lxii.

We should also mention an earlier paper, "Experiments by John R. Freeman on Curves from Two to Four Feet Radius in Fire Hose," published in the Transactions, A. S. C. E., vol. xxi, page 362.

All these tests and empirical formulae refer to the flow in closed pipes. Nothing, apparently, is on record referring to any compensation for flow in curves in open channels.

The title given to this paper is, "A Theoretical Formula for the Curve Resistance to the Flow of Liquids."

The speaker does not know positively that a theoretical formula in some form has not been given somewhere. The sources which have been quoted and two well-known hydraulic treatises, "Church" and "Merriman," do not even allude to any theoretical formula.

The engineers of the sewer department of this city have for some time been aware of the obvious necessity of increasing the fall of the sewers in the curves, so as to compensate for the additional resistance caused by the curvature of the channel.

These curves, generally, are not what could be called "easy" curves, as the sewers are, as a rule, built along the streets, and in following the natural slope of the district, have frequently to make right-angle turns, and even greater angles, and these curves must all be within the intersecting street lines at the crossings.

The records show that at least some of the earlier sewers have been built without any increase in fall around and through such curves. In the opinion of the present management of the sewer department the lack of compensation for the additional curve resistance is to be held accountable, in some cases at least, for the congestion of some sewers during heavy storms and for the consequent claims for damages by flooded cellars and for many resulting relief bills passed in the settlement of such damages.

The slopes of all sewers designed in recent years have been increased through the curves in a more or less arbitrary way. The question of the proper amount of required compensation for the greater resistance to the flow in curves has been given a good deal of special attention. The speaker has been a party in the consultations on the subject, and has subsequently given his special attention to the question.

As the subject came up in this particular form, the investigation which the speaker made, naturally applied to the flow in "open channels." The compensation for the resistance which he found, as the result of his analysis, applies to the analogous case of flow in "closed pipes," as a special case.

The speaker will proceed to present in as brief and comprehensive a form as is compatible with a certain degree of completeness, the development of a theoretical equation for the curve resistance to the flow of liquids in "open channels," and will then show its application to the flow in "closed pipes."

PROBLEM OF OPEN CHANNEL DESIGN.

The problem of the most economical design of a drain requires the computation, of the smallest size of conduit which, for a given alignment and for a given total fall, will be just sufficient to furnish the given rate of flow, or, in other words, will have the required capacity.

Rankine speaks of "flow in an open channel" as "flow in a stream," and gives this definition:

"A stream is a moving fluid mass, indefinitely extended in length and limited transversely, and having a continuous longitudinal motion."

Continuing, he demonstrates that "the normal velocities at a given instant at two fixed cross-sections are inversely as the areas of these sections."

When a stream of liquid completely fills the "pipe" or "tube" or "conduit," the area of each cross-section is given by the figure and dimensions of the conduit.

A "channel" partially encloses the stream flowing in it, leaving the upper surface free, and this description applies not only to channels, commonly so called, but to pipes or conduits partially filled. In this case the area of a cross-section of the stream depends not only on the figure and dimensions of the channel, but on the figure and elevation of the free

upper surface of the stream. The upper surface is free to conform in elevation to the dynamic conditions governed by the channel.

In a stream not uniform as to velocity and section the loss of dynamic head is the sum of that expended in overcoming resistance and of that expended in producing increased velocity, when the velocity increases, or the difference of those two quantities, when the velocity diminishes.

In a stream uniform as to velocity and section the dynamic head is wholly expended at any point along the line in overcoming resistance.

If we have a straight open stream, varying in its cross-section as to figure and dimensions, while roughness and slope of bed are uniform, the velocity will vary from place to place inversely as the cross-sections.

The velocity of a straight open stream will likewise vary when the slope of the bed is not uniform, while roughness and cross-section of the channel are uniform.

Therefore a straight open stream can only be uniform as to velocity and section when the fall is uniform also.

When we have a bend in the line of the stream flowing in a uniform channel of a uniform fall neither the velocity nor the cross-section of flow can be constant or uniform.

But in a case where a stream follows an alignment, composed of tangents and curves, we can, nevertheless, have a uniform stream as to velocity and section if the slope of the bed of the channel varies in a certain way, governed by the changes in alignment in conjunction with the velocity. (The roughness of the bounding surface assumed as uniform throughout.)

Recognizing, as we are compelled to by experience if not by analysis, that the flow through any curved portion of the course meets with a greater resistance there than in the straight course, we must come to the conclusion that through the curve more potential energy has to be expended, or in plain words, more (mechanical) work has to be performed in overcoming the resistances than in the straight course, if a uniform velocity is to be maintained throughout.

Therefore, for a curve we have to ascertain the additional potential energy required; we have to provide for a variable potential energy, capable at any point to do the work of overcoming the respective local resistances, while maintaining a constant velocity throughout; and in such a stream of uniform cross-section and uniform velocity the dynamic head is, as stated, wholly expended at any point along the line in overcoming resistance.

The principles and laws of dynamics applied to this problem will furnish the theoretical solution, which will be taken up in the next section of this paper.

Financing of Public Utilities.*

By Robert J. Graf.

THE commercial and mechanical advancement in the electrical field could have been realized only through the moneys invested in the respective enterprises. In contemplating the large electric generating plants and the great businesses established, even those in the business lose sight at times of the great debt we owe to the financial interests who furnished the sinews of war in the early days of the industry.

The capitalization of upwards of $1,500,000,000 in central electric stations is held by the general public. The securities are held by all kinds and conditions of men, residing in every State of the Union, and I might almost say in every civilized country of the world. In several of the companies of which I am an officer, more than 40 per cent. of the dividend checks are paid in foreign exchange. England and the continent have contributed huge sums of money to the development of the electrical utility business in this country.

One difficulty in the way of financing a public utility property, up to within less than ten years ago, but which to a great degree gradually has been overcome, was the finding of a ready market for these securities. The majority of investors, when they buy a security, want to know how quickly, in case of necessity, they can turn the securities into cash.

Owing to the number of companies engaged in the business—the average cost per plant as given in the Census Report of 1902 was $140,000; in 1907, $200,000; which would divide the capitalization over some four or five thousand companies—it will readily be seen that the in-

*Abstract of an address before the Electric Club of Chicago.

vesting public would require special information on almost innumerable projects to judge the merits of the various securities offered. Even today there are comparatively few electrical public utility securities listed on the great exchanges of the country. The causes outlined left the investor a limited sale outlet—the bond house or banker from whom he had purchased the securities, and a limited local market for the absorption of such securities as would be offered for sale. Under these conditions the average investor preferred to place his funds in securities which had a readier market and which, on short notice, he could convert into cash. Thus electrical securities could not compete in the broad market enjoyed by industrial, railroad and other securities listed on the stock exchanges of the country, but had to rely upon a limited class of investors attracted by the high interest return offered by utility companies for funds invested in their enterprises, or the comparatively small groups of men who realized the potential possibilities of the business and were willing to invest their funds simply on its merits.

Within the last ten years, however, the market has been greatly broadened, primarily by the realization on the part of the banking and bond interests of the intrinsic value and permanency of the industry, coupled with the fact that the business could pay, and in fact, in order to finance itself had to pay, higher rates of interest than other enterprises of like magnitude.

This was an entire reversal of form—electrical securities now being sought for market, instead of seeking a market. This is literally the case, as practically every leading banking or bond house now stands ready to purchase any amount of securities of well-managed public utility properties, while less than ten years ago the conservative financial interests would not finance electrical projects at all except those located in the large urban centers.

A new departure in the method of financing, which also has aided greatly and broadened the market for the sale of securities, is the consolidation under one management of a number of comparatively small utility plants, and through this combination the formulation of a scientific, economical and comprehensive financial plan. In this way the smaller plants in a great many instances have been financed through being grouped with other properties within operative radius, where as separate propositions, serving small populations, they would be impossible to finance by themselves. In addition to ability to finance upon a satisfactory basis, the grouping together of separate units has resulted in giving to the smaller properties highly scientific management in all departments, and through this management rendering to the community served a better service at a lower rate than possibly could be effected otherwise.

Economists for years have admitted as a fact that public utilities should be operated as monopolies and should not be subject to competition. The general public has begun to realize from many costly experiences the truth of this assertion, and largely due to educational propaganda on the part of the companies, the public attitude has entirely changed. I believe that it would be an almost impossible task to secure in a community that is at present served by a well-managed and properly conducted utility company a competitive franchise of this nature.

The newness of the business and the apprehension on the part of investors of changes which might occur over night, so to speak, which would entirely revolutionize the method of production, or render useless generating plants installed, was a fear that has been entirely overcome through standardization of the method in cost of electrical products.

Fundamentally applying to this business, as well as to all other business operations, the earning capacity is primarily the one considered by the investor. In this regard the electrical utility business has demonstrated its capacity and its ability to pay, as it has had to do, high rates of interest on its securities. While the earnings of practically every well-managed utility company in this country have steadily increased, the increase in the gross and net earnings of the electrical utility properties was particularly noticeable and was given great publicity in the year 1907, a so-called "panic" year. In that year every local utility property with which I am connected, situated in all parts of the country, increased its connected load and its gross and net earnings very appreciably. I believe you will find this to be the case of practically all utilities in the country, although in the same period of time the earnings of railroads, industrials and other companies practically without exception decreased materially.

EDITORIAL COMMENT

Competition in Public Contracts.
Gas Rates in Chicago.

COMPETITION IN PUBLIC CONTRACTS.

The discussion of Major Gillette's paper before the American Society of Engineering Contractors upon "Competition in Public Contracts," the conclusions of which were given in the July number of MUNICIPAL ENGINEERING, promises to be interesting and somewhat extended.

There are so many side lines of interest that it is rather difficult to keep close to the main point in the paper and not emphasize the features which belong really to other discussions, thus leading one away from this subject. Some of these side lines are quite as important as the main subject but they must be kept in the background, but not completely eliminated, if this discussion is to be of the utmost value.

To begin with the latest communication, that of Mr. Dieck, in the department "From Workers in the Field," elsewhere in this number of MUNICIPAL ENGINEERING: The first point made is that the public will be suspicious of a reform advocated by those most directly interested. This, it seems to the writer, is apart from the question, partly because Mr. Gillette is an engineer and not a contractor in the technical sense of that term, and partly because the value of a reform does not depend upon the source from which it starts but upon the need for the reform and the way in which it works out. If the agitation is started for the sole benefit of the contractor that fact will soon appear and the discussion will fall flat. If it is started or is carried forward for the general benefit, then the rate of advance of the discussion will depend upon the interest in it shown by those most concerned, whatever the nature of their connection with the business. It is notable that most of the interest thus far manifested, some of it not yet in print, has been by the engineers or by contractors who are at the same time engineers, those from which the American Society of Engineering Contractors derives its name and who form the nucleus and the greater proportion of its membership. The movement has every indication of honesty in inception and purpose, and its initiation by an engineer who is by nature, training and official history, independent of any entangling influences, is further evidence to allay any suspicions as to motives.

Both Mr. Dieck, and Mr. Warren in the August number, declare that the needed reform must come through the action of the engineers. This is undoubtedly true to a very large extent, and the education of the engineering profession in general is an essential to the complete solution of the problem, but this is one of the important side lines and must be left to separate discussion, this statement of its importance being all that can be used in connection with the subject strictly covered by the title of Mr. Gillette's paper.

The strictures on the administration of civil service laws are also pertinent to this discussion only in a single statement. Major Gillette has grown up in the red tape of the War Department and is thoroughly familiar with it, and, like other officers in the Corps of Engineers, can handle any matter of construction satisfactorily under its restrictions, where one brought up in the systems or lacks of system prevalent in other construction work finds himself tied hand and foot. It is natural therefore, for Major Gillette to recommend legal provisions which will bring about the result

to which he is accustomed, and to condemn the lack of system which he found in municipal public work, under which he was perhaps as helpless as the ordinary civilian would be if dropped in the midst of governmental red tape. Some of those with more or less knowledge of both methods of handling construction work ventured the prediction that the Panama canal administration would not succeed under the red tape surrounding the expenditure of governmental funds until it was put into the hands of officers of the Engineer Corps, men familiar with the system, if there were any large enough for the job. The result has justified the prediction and has demonstrated that the Engineer Corps has men suited for any duty that may be required of them. It is quite probable that the same officers, if put in charge of as large a machine operated according to the methods of the great railroads, would find themselves unable to manage it successfully.

These statements may throw light for some readers upon the reason for the form of Mr. Gillette's recommendations, and upon the reason for the objections made by those brought up under less restricted systems to the laws proposed by him, and thus reduce the misunderstanding of motives. They refer, of course, mainly to the financial transactions in construction operations and not to the engineering features, although the provisions of the civil service laws do impose some restrictions upon the latter.

Proper administration of a good civil service law will undoubtedly improve conditions surrounding the letting of public contracts, but the civil service question must be set aside for separate discussion.

Some excellent contributions to the discussion are promised for the October number of MUNICIPAL ENGINEERING, and our readers are invited to add to the number. Discussion of each of the above questions, which have been separated from the main question, is also requested, with the suggestion that each question be considered separately in its direct relations to the main question, or quite independently of it.

GAS RATES IN CHICAGO.

The report of the investigation of the rate proper to be charged for gas in Chicago, made by William J. Hagenah for the gas sub-committee of the Chicago council committee on gas, oil and electric light has been published and is of much interest. The sub-committee consisted of William J. Pringle, Theodore K. Long and Charles E. Merriam.

The report opens with a brief historical sketch of the gas companies in the city, showing the development of the present company with its $35,000,000 of stock and $40,096,000 of bonds, income of $15,500,000 a year, paying about 5 per cent interest on bonds and 7 per cent dividends on stock.

The methods pursued in making a valuation of the property are set forth in detail, with some indication of the methods of selecting unit prices, determining cost of details, etc, concerning the physical property, including the overhead construction charges. The valuations of these details are given in the report only in summaries.

The overhead construction charges included were computed for three equal portions of the life of the company. For the first period the allowance is 22 per cent, for the middle 17 per cent and for the last 12 per cent, or an average of 17 per cent for the three periods. Land is not included in the above, the charge on the present value of the land for the overhead construction charges being reduced to 12 per cent. A further allowance of 6 per cent for discounts made in the sale of bonds on the market is made and defended by argument and brief general statement of facts.

The total depreciation to date of report is less than 14 per cent of the computed cost new.

After careful comparison of the accounts for gas stores, accounts receivable, pay roll, cash, current liabilities, etc., the working capital is fixed at $3,200,000, approximately $1,000,000 of which is the minimum of cash to keep on hand.

Concerning the omission of the value of the franchise from the valuation of the plant for purposes of determining the proper rate to charge for gas, the

report says: "A franchise authorizes the use of private property in a particular manner and generally conveys an exclusive right. In this particular instance the right issued from the people for the specific purpose of having the grantees of that right use it for the public good in the operation of a gas utility and with such profit to themselves as was represented by a reasonable return upon the capital actually invested. There is no proof that the company paid any value for this original right. It was a grant for which the people received nothing in return except the service to be furnished. The company made no franchise investment of its own at the time or thereafter. Its expenditures in constructing the gas plant and the development of the business represented investments in the business and not in the franchise. It is only by virtue of the franchise that the business itself could be developed. The mere granting of such a franchise or privilege conveys with it no right on the part of the grantees to a separate value in the franchise above the amount paid for it, distinct from its use in the business for which it was granted, which the parties may capitalize as against the public in rate adjustment proceedings. To grant a value for the franchise as against the public, when no payment was made therefor to the public, would be to increase the value of the investment of the company and hence increase the cost of gas."

The cost of securing business is quite thoroughly discussed and the various empirical rules for estimating it are compared, and the results are shown to differ within a range of some ten per cent or more.

The total cost new of the whole plant, $49,023,947, is subject to a reduction of $6,786,538 for depreciation, and an increase of $3,200,000 for working capital. The allowances for these items and the cost of getting business are worked out year by year, beginning with a total value of $39,000,000 in 1897, and making the additions for 7 per cent return on investment, for additions to plant and interest thereon and for operating expenses, and deduction for gross earnings. The result each year is the cost of the plant for that year, with which to start the computation for the next year. This process brings the total cost of the plant at the close of 1910 to $60,933,630. To this is added $916,249 for construction work not yet technically completed, making the total $61,849,879, as compared with the total stock and bond issues of $75,096,000.

This excess, except such part as is promotion charge or water, is undoubtedly value of the franchise as a revenue producer under the conditions as they have existed heretofore. It is now recognised that this franchise value, which has never been paid for by the company, is the property of the city, and should not be considered as a part of the capital of the company on which the consumers of gas must pay interest or dividends.

When natural gas and property not used used in the artificial gas business is eliminated, the value of the artificial gas plant becomes $51,575,678, upon which interest, depreciation, etc., for such plant must be computed for 1911.

The revenues and expenditures are briefly analyzed, and with some minor adjustments are accepted as correct. The charge to be made for the future for depreciation is then discussed and an average of 2 per cent of the depreciable property is allowed as a charge against the revenues of the plant before determining the net profits. Likewise 7 per cent is demonstrated to be a fair interest return upon the valuation of the property.

The final tabulation in cash and in cents per thousand feet of gas made, is as follows:

Operating Revenue.			Per M Sold
Gas Sales	$13,663,168.01		$0.8496
Tar Sales	130,944.03		.0081
Penalties	167,462.09		.0104
Arc Lamp Rentals	340,873.31		.0212
Total Operating Revenue		$14,302,447.44	.8893

			Per M Made
OPERATING EXPENSES.			
Manufacturing—			
Steam Material	$ 160,451.74		.0112
Generator Material	2,874,299.24		.2007
Purifying Material	11,541.61		.0008
Station Supplies	30,279.35		.0021
Manufacturing Labor	341,832.68		.0239
Works Repairs	117,845.48		.0082
Engr. Dept. General Charges	45,897.73		.0032
Total		3,582,147.83	.2501
Gas Purchased and Allied Expenses		748,157.06	.2965
Distribution—			Per M Sold
Distribution Station Operation	$ 82,924.54		.0052
Street Mains Maintenance	331,297.94		.0206
Service Pipe Maintenance	146,905.32		.0091
City Lamp Post Maintenance	16,599.98		.0010
Meter Maintenance	313,799.99		.0195
Gratuitous Work	151,112.78		.0094
Arc Lamp Maintenance	308,701.58		.0192
Total		1,351,342.13	.0840
Commercial Expense—			
Promotion Expense	$ 139,701.50		.0087
Branch Store Expense	22,355.32		.0014
Appliance Expense	104,702.22*		* .0065
Total		57,354.60	.0036
Office Expense:			
Turn On and Off	$ 61,752.89		.0038
Statement Taking	96,918.76		.0060
Bookkeeping	165,082.99		.0103
Collecting	136,025.56		.0085
Applications, Receiving, Auditing, etc	236,637.63		.0147
Total		696,417.83	.0433
General Expense—			
General Office Expense	$ 397,834.55		.0237
Telephone Rentals	21,666.02		.0013
Rent	156,219.79		.0097
Legal Expense	26,338.56		.0016
Claims and Damages	54,000.00		.0034
Employes' Aid and Pensions Fund	133,372.00		.0083
Uncollectable Bills	60,508.01		.0038
Fire and Property Damage	42,,000.00		.0026
Main Rentals	53,493.00		.0033
Lease Rentals	340,000.00		.0011
Total		1,267,431.93	.0788
Taxes		848,115.00	.0527
Depreciation		642,487.00	.0399
Sundry Revenue Requirements		153,941.00	.0096
Total Operating Expenses		9,347,394.38	.5812
NET EARNINGS.		4,955,053.06	.3081
Non-Operating Utility Revenue:			
Interest	$ 50,000.00		.0031
Rentals	17,591.06		.0011
Miscellaneous	11,704.57		.0007
Total Non-Operating Utility Revenue		79,295.63	.0049
Gross Corporate Income		5,034,348.69	.3130
Deductions from Gross Corporate Income:			
Return on Investment at 7%		3,610,297.00	.2245
SURPLUS		$1,424,051.69	.0885

*Profit credited.

The surplus assumed at 8 cents per thousand cubic feet is taken to be the excess of revenue which the company receives beyond a fair return. It is therefore recommended that under present conditions the rate should be 77 cents instead of the present rate of 85 cents per thousand cubic feet.

The present requirements are 22 candle-power and 600 B. t. u., and the company supplied in 1909 24 c. p. and 685 B. t. u., on the average. Reduced to the standard of other large cities, gas could be supplied for about 73 cents per thousand, and this superiority in value must be considered in comparing the price computed as above with that in other cities, especially those having particularly low prices.

The final conclusions are presented in the following table:

Chicago Gas Rate.	1910.	1909.
Total value of investment	$61,849,879	$58,060,210
Total value of physical property	49,023,947	44,494,972
Total "going value" as defined in the report	9,425,932	10,365,238
Gas utility investment, including used proportion of office building		53,075,598
(Office building excluded from income account investment and rental charge for space occupied provided.)		
No allowance made for value of franchises.		
No allowance made for the cost of street pavement over the Company's distribution system not paid for by the Company.		
Allowance for working capital		$3,200,000
Allowance for depreciation		642,487
Allowance for taxes		848,115
Rate of return allowed on the investment		7%
Gross operating revenues		14,302,447
Non-operating revenues		79,296
Present actual earnings available for interest and dividends		5,034,349
Allowance for return on present value of utility investment at 7%		3,610,297
Surplus in 1909 after allowance for interest and dividends		1,424,052
Present rate for gas	95 cents per M gross—85 cents per M net.	
Rate recommended	87 cents per M gross—77 cents per M net.	
Saving to public at 77 cents per M on 1909 basis		1,282,299
Probable saving in five years		7,400,000
Earnings available for interest and dividends under proposed rate.		3,752,050
Surplus under proposed rate after allowance of 7% for return on investment		141,753

The report seems to be upon a fair basis, and so it falls between the demands upon the one side that the rate be reduced to 70 cents and on the other that it remain in the neighborhood of 85 cents. It doubtless represents Chicago conditions, although there is a slight tendency in some places toward rather high valuations. When compared with the Indianapolis rate, with which the writer is somewhat familiar, several reasons for the higher rate in Chicago are shown. While the heat requirements are not far different, Chicago seems to be getting gas with somewhat higher heating value. Chicago has a high lighting requirement while Indianapolis has none for the new company and is not required to treat the gas to bring up its candle power, thus saving some money. The by-products of the Indianapolis plant are far more valuable and their sale reduces the cost of the gas as manufactured to a very low figure. The distribution system with which the Indianapolis company began business was purchased at a low price, which reduces the interest charge to some extent, though ultimately it may increase the expenditures for pipe renewals, though this promises to be rather remote. The charge for getting new business was also less in the Indianapolis case, much of the early business being anxious for the service and requiring only slight modifications of the pipes and connections to utilize the new system.

THE QUESTION DEPARTMENT

Foundation for Sewer in Quicksand.

We are constructing a five-foot reinforced concrete block sewer of Parmley and Nethercut construction in our city. The sewer is going to be built along the course of a creek, so there will be more or less water flowing in the trench all the time. We will probably encounter some quicksand. Will you please let me know what would be the best method to secure a good foundation on the same.

W., ———, Wis.

The exact method to be used can be determined only by the engineer or contractor on the ground, for any method proposed must be modified to suit the special difficulties met, and one method may not be applicable while another may be quite successful.

The article on "Sewer Trenching in Wet Sand" in MUNICIPAL ENGINEERING, vol. XXXV, p. 143, describes in considerable detail a method of pumping the water out of the sand by means of well points driven into the ground ahead of the excavation, so that the sand can be shoveled out with ease and the water can be kept down below the bottom of the excavation until the sewer is laid.

In many cases no special foundation is necessary, provided the water is kept below the sewer until it is thoroughly set in place and filling over it has begun.

Folwell's "Sewerage," ($3) devotes considerable space to methods of handling quicksand, nearly all of which proceed on the principle that a sub-drain should be laid under the sewer to keep the water down and that gravel or broken stone or in some cases cinders should be filled in around this drain tile to the level of the bottom of the sewer, this filling being sufficient foundation under ordinary quicksand conditions. Cradles or concrete are also described for use when the looser form of foundation is not sufficient.

Quicksand can frequently be drained by keeping a length of trench open for a considerable time so that the ground water can be drained down, when extension of the trench will find comparatively dry soil in which to work. This is less expensive of money, though more expensive of time, than the wellpoint method described, when it is applicable. In a rainy season or in a wet climate, methods of getting rid of the water which require much time are not so applicable, for the water in the source of supply is renewed too frequently for the drains to have full effect.

Books on Water Works.

I would like to get a book or set of books especially on the placing and construction of water plants. I would want the best and up to date books that are now printed. I have an encyclopedia of civil engineering, which devotes almost one volume to the subject of water works; but you will understand that I want a book or books alone devoted to subject spoken of above.

M., South Sharon, Pa.

Probably the best books for our correspondent's purposes are Folwell's "Water Supply Engineering" ($4) and Turneaure and Russel's "Public Water Supplies" ($5). The latter is the more comprehensive, but the former has some practical details of construction which should be very valuable for the young engineer.

Customary Measurements of Curb and Gutter and Pavement Areas.

I should like to hear through your question department as to what is the custom generally followed by engineers in making final estimates on paving. On concrete curb and gutter is the space taken up by inlets deducted from total length as estimated to contractor, or the total length including inlets given as final measurement? And in brick pavement with cement filler where large expansion joints are left at gutters, are expansion joints included in the area of pavement in final estimate?

I have known cases where engineers have made estimates both ways and should like to hear what is considered fair to both municipality and contractor on this point.

L., ———, Ill.

Will our readers report their practice? The writer measures the entire length of curb without deducting inlets, the extra work in finishing curb at inlets and setting the same being considered equal to the displaced curb and gutter. The inlets or the catchbasins are also charged at the price bid, which includes the furnishing of the materials and the construction of the basin or inlet connection.

In measuring area of pavement the entire area between gutters is measured, the expansion joints being included in the area of pavement. Their presence increases the cost of the pavement and they are as truly a part of it as is the regular surface. The writer knows of no place where the expansion joints are paid for separately, and they must certainly be paid for.

Duplicate Water Supply Systems.

Can you advise the writer of any city or cities having a population of ten to twenty

thousand, who have installed and are using the duplicate system of water supply, one being for domestic use and the other for street, lawn sprinkling, and other purposes?

We have a limited unexcelled pure water supply, and there is being developed a sentiment among certain citizens in favor of such a system, and the writer is endeavoring to get some information on the subject from cities that have followed this course.

Board of Public Works,
———, Mich.

Can our readers refer us to such systems? Fifteen or twenty of the larger cities in the United States now have high-pressure fire systems which may be used to some extent for the purposes mentioned, but not largely, because they usually cover only the districts of special fire hazard or congestion in the business and manufacturing parts of the city.

Concrete Mixer for Asphalt Paving Materials.

Can a concrete mixer be used for mixing asphalt paving materials?

It seems to me that a common mixer in conjunction with a sand drier and asphalt kettle would have certain advantages over a regular paving plant for small jobs.

Have any of your readers had any experience along this line?

R. F. S., San Francisco, Cal.

Some concrete mixers would be very unsatisfactory as mixers of asphalt paving materials while others might work very satisfactorily. The principal requirements in an asphalt pavement mixer are ease of passage through the mixer so that the cooler material sticking to the sides will not clog the machine, small area of sides and blades of mixer to reduce the cooling area to a minimum, rapid movement of blades of mixer and thorough stirring of the mixture so that the batch can be dumped as quickly as possible before it has an opportunity to cool, freedom of danger of clogging of the axis so that the mixer is not in danger of stopping on this account, no corners in which the mixture can lodge, openness of construction so that cleaning of the mixer by means of tools or of heat is easy.

Many concrete mixers will not answer any considerable number of these requirements, and none of them answer them all. It is quite as easy to mount an asphalt mixer on a portable truck as to use a concrete mixer, and the machine will cost no more.

For a single job the concrete mixer could be used, but it is quite probable that the mixer would be seriously damaged for use as a concrete mixer thereafter.

For small jobs it is quite common to use a heated pan and mix the paving mixture by hand, but for continuous small work with a portable plant the mixer can be used.

Several such portable paving plants of various sizes are on the market, such as the Atlas Dryer Co., Cleveland, O.; the Continental Asphalt and Equipment Co., Chicago, Ill.; F. D. Cummer & Son Co., Cleveland, O.; East Iron and Machine Co., Lima, O.; Iroquois Iron Works, Buffalo, N. Y.; Tidewater Iron Works, Hoboken, N. J., and others.

Depreciation in Cast Iron Pipe.

The town is considering the purchase of the water works system owned by a private corporation, and in appraising values the question has arisen as to the proper rate of depreciation to apply to the equipment in general. We have data at our office, which we can furnish the council with respect to the proper rate of depreciation on steam boilers, steam pumps, buildings, etc., but have no data relative to the proper rate of depreciation to apply to cast iron and wrought iron water pipes, hydrants, etc.

We infer that you may be in possession of considerable valuable data on this subject. If our inference is correct, we would be pleased to have you wire us Monday at our expense, whatever data you have with respect to the proper rate of depreciation to add to a water plant and equipment in general, especially pipe and hydrants.

The larger mains are, of course, cast iron, with bell and spigot joints, lead calked. The soil that they are laid in is principally gravel, with some clay. The greater portion of the pipe has been in the ground for approximately 28 years. The pressure carried has averaged 50 to 60 pounds. The water, a greater portion of the time, has been collected from streams and springs three or four miles from town, and, as far as we know, has contained nothing injurious to the pipe. Probably one-fifth of the time well water has been furnished. This has been rather hard, but, as far as we know, there has been nothing about this that would be more than ordinarily injurious to the pipe and equipment.

The mains are from 6 to 10 inches in diameter, and the distributing portion has been cleaned once only by having a scraper drawn through. This cleaning was performed last year.

The information, to be of value to us, should reach us Monday, and if received from you will be of considerable value in checking up the appraisers. Do not hesitate to make your telegram lengthy, if necessary to fully cover the matter.

L., ———, Pa.

Cast iron pipe will last fifty to eighty years, wrought iron half as long, both estimates being approximate averages, dependent on soil conditions. Fifty per cent. depreciation in thirty years is a fair allowance, if exact information is lacking. It is safest to make examination of pipes in numerous places in normal condition and where electrolysis or chemical action is possible, which, quite probably, will show higher present value of pipe in general and lower present value where electrolysis or soil conditions are dangerous. Hard water is probably favorable to life of pipe. The cleaning should have supplied some valuable information. Examination of pipe at least once a mile, where conditions are uniform, and oftener in critical areas, is recommended, if accurate estimate of value is wanted.

Estimates of depreciation are all right in making estimates of the probable necessities of a plant as to raising money to replace parts which are worn out, but when it comes to the problem of determining what the present value of a plant is, this method is not very accurate, because the deterioration

of a plant depends upon so many special conditions that any general allowance made in advance may be quite far from the truth in any particular case. In this case, assuming a street railway system, some parts of the city may require much less allowance for deterioration than other parts, and it would, of course, be impossible for an engineer to give any definite estimate of the present value of the different parts of the plant without an investigation. It will not cost much to dig a few holes, so as to uncover portions of the pipe in different parts of the city in sufficient numbers to make a very close approximation to the present value of the pipe.

In Indianapolis a rather careful estimate was made of a system of wrought iron gas pipe which had been in the ground for nearly twenty years, and they were valued at about one-half their cost to replace new, but when the pipes were put into condition for operation under the new conditions, it was found that they were practically as good as new, and that all that was necessary to put them in operation was to make the changes necessary to fit them to the new conditions. This was true with respect to all of the system except near one or two streams, and where there was electrolysis.

From the point of view of the water works company it would be desirable to show that the water pipes generally in the city were in practically as good a condition as when they were laid. It is very possible that this is true. A hard water will not affect the interior of the pipes materially, and the character of the sediment which was taken from the pipes in the process of cleaning will show what, if any, has been the effect of the water on the pipes. It is quite possible that there was no effect.

The holes dug, as suggested, would uncover the outside of the pipe, and it could be determined whether there had been any action of corrosion on the outside of the pipe.

On the city's side it would be desirable to show whether there has been electrolysis, or whether in certain localities, especially those where considerable filling has been done, there might be chemical action upon the outside of the pipe which would render it less valuable because its life had been shortened. A few holes dug to determine the condition of the pipe, and an electrolysis survey to show where there was danger of pitting on account of electrolysis, would make it easy to show what parts of the system had deteriorated and might possibly be of no value, because the pipes should be shortly taken up and replaced. This examination should be made by an engineer who has made a study of this subject.

Metal Monuments Set in Concrete Walks.

I have been looking for some descriptive matter relative to metal monuments made of aluminum or brass disks, to be set on the five-foot line in concrete walks. Can you send me a cut or descriptive matter concerning this?

J. B. H., Connellsville, Pa.

The simplest marker of this sort is a small section of brass or copper rod, set in the concrete, so that it will be flush with the surface and will extend through the wearing surface and be embedded in the foundation layer. It is easiest to set this when the walk is laid, but it can be set in place by carefully boring a hole in the walk, the length of the rod and slightly larger in diameter, and then embedding the rod in cement mortar so that it will be held firmly in place. The top of the rod should be smooth and conform with the surface of the walk. The sides may be roughened to give the cement a better hold. The exact center of measurements may be marked by two deep chisel cuts at right angles to each other. If the walk is subject to wear, the cuts can be deepened as the rod wears, by a couple of additional blows on a chisel.

Will our readers give descriptions of any markers of this sort that they may have used?

Other forms of street monument are described in articles in MUNICIPAL ENGINEERING, such as those for house sewer connections, in vol. xl, pp. 130, 225; for boundaries, vol. xxxix, p. 203; for sidewalk nameplates, vol. xxxii, p. 246; on establishing monuments, vol. xxix, p. 432, and xxvii, p. 258; on concrete street monuments, vol. xxv, pp. 26 and 88, and xxiv, p. 433, etc.

Illinois Law for Straightening Streams.

Upon the advice of our city engineer I am writing you this letter. You will note by referring to the Revised Statutes of Illinois, 1909 edition, section 334, of chapter 24, and the paragraphs immediately following, that certain rights are given to cities and villages therein. I should like to know whether any city or village in the State of Illinois has ever straightened a natural channel and collected for the same by special assessment, under section 334, of chapter 24, and paragraphs immediately following. I have carefully looked into the matter and have never found whether that has been done by special assessment by any city or village in our state. H. & S., ———, Ill.

The drainage law of Illinois can apparently be applied to cities as well as to country districts. The only cities known to the writer to which it is proposed to apply the law are Champaign and Urbana, by means of extensions of the work of the Saline Branch Drainage Commission. This work has not been done, but the preliminary plans have long been under discussion, and there is no question of the applicability of the law, even though covered storm water sewers compose most of the works contemplated. The cost would be met by assessments on the property benefited. The writer knows of no instance in which the particular act referred to has been used.

Can our readers give names of other Illinois cities acting under either of these laws and some statement of the work done or proposed?

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Letting of Contracts for Public Improvements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The earnest effort of Major Gillette to improve the methods in operation in the letting of contracts for public improvements, which received your attention in the July issue, and was later discussed by Mr. Warren, calls for more than a passing discussion by engineers. It is a serious endeavor to better a very difficult situation, yet in my humble opinion the solution presented is not adequate and reveals some decidedly weak points. Although, as Mr. Warren asserts, the great mass of contractors is not to be broadly charged with dishonesty in the execution of their contracts, yet the attempt to originate any reform from among any association in which they are the controlling element will undoubtedly bring public mistrust at the very inception of the movement. Such reform must, in my belief, come through action of the body of engineers.

Specifications for public work are usually drawn either in a very loose and insufficient manner or with the greatest severity. With specifications of the first kind, the unscrupulous contractor anticipates large profits from an interpretation of the contract other than the intention of the engineer. With those of the second, he expects a liberal interpretation by the official in charge, and, though adjusting his bid to allow for rigid enforcement, looks for a larger margin of profit in a milder enforcement than the specifications would seem to require. Severity in specifications has often frightened off an honorable contractor, and has left the field to the favored one, who, through influence or pressure, has been able to accomplish his selfish ends. The public cannot hope to secure the most favorable results by either one or the other of those methods of drafting specifications. Either the contractor, so minded, will endeavor to take advantage of every technical point to avoid compliance with the intention of the contract, or he will seek by devious means to secure favorable rulings. It is to circumvent just such harpies that the proposed legislation of Major Gillette is designed, though his proposition makes, too, for unreasonable severity in some regards.

In the third suggestion he urges publication of the advertisement for bidders in three local papers of general circulation in the community in which the work is to be undertaken. In such a sparsely settled country as Oregon, where population is scattered and the public press is rather restricted, the matter could hardly be handled in this manner. Recourse ought therefore to be had to the reputable technical journals, and notice in one of the local papers of acknowledged standing ought to be sufficient. This is not an insignificant point in that section, for though the population be quite small, considerable work in municipal improvement is being undertaken. There need, consequently, be no such arbitrary subdivision of contracts into classes as proposed, but all advertisements for work—of sufficient volume to attract other than local bidders—might be made on the same basis. The limit for this amount ought to be rather liberal, for the assembling of contractor's plant in the western country often interposes considerable difficulties and expense. The limit of $100 for purchases in the open market without the formality of inviting bids is inoperative, for the official facing an emergency requiring a greater expenditure will be tempted to split up his order into several parts and to place it so that the letter of the law would not be violated. This technical violation of the law has often been committed and without a rigid examination of accounts is not easily discoverable. As Mr. Warren well remarks, there is implied in such an attempted regulation a mistrust of public officials and an unreasonable restriction is imposed upon them. It is far more sensible to place the matter more freely in the discretion of the official and to hold him accountable for his actions. This, of course, implies at the same time that the body of officials will be actuated by good motives, still by proper selection and retention the result may be good.

The proposition to reduce the length of specifications to the simplest and most inelastic language calls for the hearty agreement of all engineers. It is common knowledge that the terms used in many specifications admit of the widest interpretation and open the way to constant and disagreeable discussion and controversy. The practice of covering the matter by protracted descriptions is worthy of the greatest censure, and

until this practice is corrected the engineering profession must continue to be subjected to severe criticism. The submission of doubtful matters to boards of arbitration is an excellent suggestion, yet if the plan outlined by Major Gillette be carried to its ultimate analysis, it defeats itself. The courts, as is well known, are jealous of interference with their functions, yet they will undoubtedly view with favor adjustments of difficulties, provided questions of fact only are concerned. In the plan proposed the contractor, though agreeing to abide by the decision of the board of arbitration, is privileged at any time to transfer the matter to the courts, and the whole object of the board will be defeated. It will be impossible to secure complete adjustment of all difficulties by any such artificial arrangement, yet many of the unpleasant and inconsequential controversies that now block our courts would be quickly dissipated. The courts would unquestionably view with disfavor any effort to suppress the right of a citizen to make objection to the manner of settlement of a difficulty, still if they felt that no serious interference with constitutional rights had been imposed, they would soon come to regard the plan with some concern. In the long run the best interests of the community will be served by such boards, for decisions will be immediate, and what is more to the point, made by experts on the spot.

The suppression of the words "discretion of the engineer" or others of like intent, cannot, in my opinion, be reasonably allowed, for in the course of any work questions must arise which no specifications, however carefully drawn, can comprehend. The board of arbitration might as a board of appeal settle such a difficulty, but frequently contingencies arise that even this artificial expedient could not in proper time determine. The effect of the section certainly is to make the official merely a watchdog, without the presumption of reasonable intelligence. It is true that a multitude of sins have been committed under the protection of this saving clause, still the official who values his self-respect and a reputation for fair dealing does not call this clause to his aid without sufficient warrant. The policeman, although armed, does not enforce his orders by display of his weapons, but in time of stress he is in position to meet the contingency. In somewhat a similar way the engineer is armed and fortified.

What is most needed in public life is a body of officials, sufficiently remunerated to permit of the selection of the most competent, and so protected that they may feel their continuance in the service to be permanent as long as their conduct be good. The miserable salaries allowed to engineers in public life and the almost certainty of subjection to unfair and bitter criticism have served to frighten off many worthy men and have made of the service a roosting place for the aged and the weaklings. The civil service acts in force do not materially better this, for protection afforded is seldom sought except by the incompetent in time of stress. Politicians are too shrewd to allow themselves to meddle in technical matters and realize thoroughly that a corps of trained technical assistants cannot be collected by favors. Once in the service, it is difficult under present conditions to dislodge an incompetent, unless he commit some particularly flagrant act, which calls for summary treatment. And so in large measure such acts are a positive hindrance to an official who is endeavoring to secure the best results for his employer. In this I can speak feelingly and with some intimate knowledge, since I have had occasion in the government service to test the strength of the civil service act, by seeking to remove incompetent and dishonest employes. It is my experience that little short of a proof of murder will serve as a reason for discharge of a worthless servant, and that in most cases the official making the charges must first prove his innocence. Unless we are able to attract to the public service by generous treatment, both in the way of salary and a larger measure of authority and control of works, it is hopeless to look for much improved conditions by regulation. In the majority of cases the engineer stands towards the governing body in the position of genteel messenger boy, and following correction of this condition must come any real betterment of the methods in vogue in the letting and enforcement of contracts. It is, however, a matter of surprise to me that an officer of the engineer corps, which is least affected by restraint of any class of engineers, should make a serious proposal to further reduce the activity of the profession as he has done.

ROBERT G. DIECK, C. E.,
Portland, Oregon.

Best Pavement for Steep Grade.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I note in your issue of March last an inquiry as to the best material for a street improvement from a safety point of view with a grade of ten per cent. Perhaps our experience in Yonkers, which is a very hilly city, may help answer this inquiry.

We have tried all the standard pavements except wood, and we find that granite is too slippery for grades over 8 per cent. We use macadam on most of our hilly streets, but we have had very satisfactory results with bitulithic on grades up to 11 per cent. One street paved with bitulithic on this grade is now ten years old and in good order. The only thing that has been done to it since it was laid, was to cover with coarse screenings the first year or two where the bitumen showed a tendency to work to the surface in very warm weather. For light traffic I consider this pavement excellent up to 10 per cent grades, and I know of none better.

S. L. COOPER, City Engineer.
Yonkers, N. Y.

A Rock Asphalt Street with Continuous Asphalt Surface.

The Neuchatel Asphalt Company, of New York, supplies the following information regarding the rock asphalt street on Thomas street, New York City, some description of which appeared in the July number of MUNICIPAL ENGINEERING, vol. xli, p. 70.

The asphalt used is mined in Travers, a province of Neuchatel, Switzerland. In pavement construction, such as was laid on Thomas street, the asphalt is mixed with a quantity of sand and molded into blocks 10 by 10 by 1¾ inches. A 4 or 5-inch concrete base is laid and upon this is spread a layer of sand and cement mixed dry. The blocks are then laid upon this and flushed with water, which runs between the interstices and wets the sand and cement layer. After a short time a layer of Neuchatel asphalt, mixed with a quantity of flux sufficient to give it a rubbery consistency, is spread over the entire surface to a depth of from ¼ to ½ inch. This layer forms the wearing surface.

There is a short alley about 150 feet long adjoining Thomas street which has been in use under heavy teaming for about eight years. Except for occasional patching this pavement has needed no attention. The patching was only necessary in the surface coat of asphaltic rubber. The pavement resembles asphalt in appearance but is more resilient and shows the hoof marks a little more plainly. In spots where the surface coat has worn off (there were only one or two on the 8-year-old alley) the blocks beneath show little or no wear. The cost, $4.25 per square yard, is rather high, except for such special uses as bridge floors, garage and fire house floors, etc.

A bridge on Riverside Drive in New York City has been in use for fifteen years, and the Eighth street viaduct in Cincinnati has also been used for a number of years.

A Concrete Pavement with Bituminous Wearing Surface.

To the Editor of MUNICIPAL ENGINEERING:

Sir—During the past few years a distinctly new type of pavement, consisting of a properly constructed concrete base and a thin wearing surface of bitumen and sand, has been developed and extensively used on the main streets at Ann Arbor, Mich., and to a somewhat more limited extent in other cities and towns.

About four years ago, in order to prolong the life of the asphalt block pavements, which at that time showed considerable wear, Mr. E. W. Graves, city engineer at Ann Arbor, as an experiment tried covering the surface of the pavement with a thin coating of coal tar and sand. After being subjected to various conditions of traffic for two years, this thin wearing surface proved to be so satisfactory that Mr. Graves determined to try it for new construction work on a concrete base. During the summer of 1909 one block on a residence street was paved with concrete having a coal tar and sand wearing surface. In 1910 approximately 18,000 square yards of this pavement were laid, the same type of construction having been adopted for an additional 63,000 square yards on nine main streets and alleys. This year there will be laid in the neighborhood of 100,000 square yards, petitions having been received for a greater yardage than it will be possible to construct.

Ann Arbor has a well-drained, somewhat sandy sub-soil, and the concrete pavement is laid directly upon the sub-grade without using a sub-base, which would be necessary where a heavy, wet, poorly-drained sub-soil is encountered. The concrete pavement proper consists of a 4½-inch gravel concrete base and a 1½-inch wearing surface, mixed one part cement to two parts clean, coarse sand. The concrete is laid in strips one-half the width of the street wide and 25 feet long, an expansion joint from ¾ inch to 1 inch in width being placed every 25 feet across the street perpendicular to the axis and at each curb.

The surface of the concrete is given a wood-float finish and slightly roughened by brushing with an ordinary hand street broom. After finishing a section as described, the form at the center or crown of the street is removed, and the pavement for the other half of the street is laid, the new concrete being deposited against that which has been previously placed, so that while there is a joint at the crown of the street it is hardly perceptible. This joint would be decidedly objectionable were it not protected by the wearing surface of bitumen and sand that is later applied, and may be eliminated by laying the pavement in sections extending across the full width of the street. This is possible and has been successfully done where concrete pavements have been laid on streets wider than those at Ann Arbor.

After the concrete has hardened the surface is covered with hot bitumen applied with a sprinkler wagon designed for the purpose, having a firebox under the tank to heat the material. The bitumen is immediately distributed evenly over the surface of the concrete by brushing with an ordinary street-sweeping broom, and the surface is then covered with sand. Approximately one-half gallon of bitumen is applied per square yard of surface, and a cubic yard of sand will cover about 30 square yards, making the wearing surface from ¼ to ⅜ inch thick. For the first pavement laid Mr. Graves used ordinary coal tar obtained from the local gas works. Later on he tried distilled tar and considered that this was more satisfactory than the crude tar. This year he has used "tarvia," has experimented with asphalt and a specially prepared bitumen known as "Dolarway."

The work at Ann Arbor is done by the city, which has its own equipment, purchases material and hires the labor. In 1910, with

common labor at $1.75 to $2.00 per day, cement from $1.07 to $1.32 per barrel asd gravel at 75 cents per cubic yard on the street, the cost of a 6-inch concrete pavement and wearing surface of bitumen and sand has varied from 71 cents to 88 cents per square yard; the total cost, including light grading and a 6 by 8 by 14-inch curb on each side of the street, varied from 94 cents to $1.16 per square yard of pavement on streets 30 and 34 feet wide. With "tarvia" at 8 cents per gallon and sand at 75 cents per cubic yard the cost of materials and labor for the wearing surface has been approximately 5 cents per square yard. These figures are for the actual cost of construction with materials and labor as given.

The materials required for the construction of this pavement are to be found or easily obtained in all localities, and the equipment necessary, besides the usual tools owned by every contractor, consists simply of a suitable concrete mixer, a tank wagon for sprinkling bitumen, an ordinary street sweeper and a wagon provided with a sand spreader.

The concrete pavements at Ann Arbor have been subjected for the past two years to all conditions of traffic of a city of 15,000. Kansas City has a small stretch of similar pavement on Sixth street, which has been exposed since last fall to the heaviest traffic in the city, and is today in first-class condition. Based upon the results obtained in these two cities, this type of construction is to be considered as suitable for paving residence streets, alleys, courts and squares, country roads and highways. It is said to meet the demand for a low-cost, durable pavement, approximately in first cost that of an ordinary macadam road and in durability that of our better types of street pavements.

UNIVERSAL PORTLAND CEMENT CO.,
Chicago, Ill.

A New Portland Cement Plant.

To the Editor of MUNICIPAL ENGINEERING:

Sir—On August 15 the Tidewater Portland Cement Company formally opened its large Portland cement plant at Union Bridge, Md. Governor John K. Tener, of Pennsylvania, was present and threw in the switch that put in operation the machinery of the new plant. A special train brought a large number of guests from Baltimore, New York, Pittsburgh and other points to witness the inauguration of the new enterprise, which is one of the largest in Maryland.

The plant of the Tidewater Portland Cement Company is located at Union Bridge, Md., 45 miles from Baltimore, on the line of the Western Maryland railroad. It is exceptionally well situated, as it commands both the markets of Baltimore and Washington, and is also near enough to tidewater to reach most of the Atlantic seaboard cities at a low freight cost. The plant has a capacity of 1,000,000 barrels of Portland cement and 25,000 tons of hydrated lime annually. In addition to the above the Tidewater Cement Company will manufacture a water-proof cement, and also white Portland cement.

The hydrated lime plant has been in operation for about a year and its product is now well known in its territory.

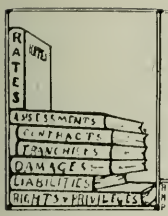
The raw materials at Union Bridge consist of an unusually pure limestone, resembling marble in appearance, and a volcanic shale. These two materials are found side by side within a hundred yards of the mill, and the deposits are practically inexhaustible.

The power plant of the Tidewater Portland Cement Company is equipped with Rust vertical boilers, which are fed by Roney stokers, and with Wisconsin engines directly connected to General Electric Company's generators. All the machinery throughout the mill is electrically driven. Even the elevators and conveyors have their separate motors. All three grinding plants, raw mill, coal mill and clinker mill, are equipped with Fuller-Lehigh mills. The kilns are 8x125 feet each and were made by the Vulcan Iron Company. The dryers and coolers were also made by this firm. The dryers are three in number, one for shale and two for limestone, and are arranged so as to take the waste heat from the kilns, making hand-firing unnecessary, and so saving fuel. Each kiln is provided with its own cooler, and these latter are placed below the kilns so that the air for combustion must pass through them, and thus become pre-heated by the hot clinker discharged from the kiln.

The crushers are four in number. One No. 8 and two No. 6's are used for limestone, while the other No. 6 is used for shale. The No. 8 crusher is arranged to discharge directly into the No. 6. The stone is handled by means of pan conveyors. The coal for both burning and power is discharged from a trestle onto a pile, beneath which runs a tunnel, and in this tunnel a belt conveyor. There is also a large clinker storage. The storehouse will hold 80,000 barrels and is equipped with self-emptying bins and Bates valve packers. Avery automatic scales are used throughout the plant, both for mixing and recording.

The officers of the company are: John K. Tener, president; J. T. Fanning, vice-president; B. T. Scott, vice-president; Owen B. Murphy, secretary and treasurer; Richard K. Meade, general manager; R. N. Soper, sales manager; J. Dreisbach, superintendent; Dr. E. A. Slagle, chemist.

RICHARD K. MEADE,
General Manager, Baltimore, Md.



MUNICIPAL MATTERS IN COURT

Higher Courts—The Laporte, Ind., Water Works Case.

Decisions of the Higher Courts of Interest to Municipalities.

Contract Not Legal Unless the Advertisement for Bids is Regular.—The city's proposals for bids for construction of a sewage disposal plant, which, under Greater New York Charter and regulations established thereunder, were required to state the nature and extent, as near as possible, of the work required, were not sufficient to furnish the basis for bids, so as to authorize a contract thereon; they in effect allowing any method of sewage disposal and arrangement of appurtenances according to any system, and according to plans and specifications to be submitted with a bid.—Hart v. City of New York (N. Y.), 94 N. E. 219.

Different Bonding Questions Must Be Submitted Separately.—Where municipal authorities desired to enter into a contract whereby the other contracting party should supply water for the term of 20 years to the city and its citizens, the municipality to agree to pay for the water used by it at a certain rate for the term mentioned, and whereby the other contracting party was to furnish to the city electric light for the same period, and the city was to pay therefor at a certain rate per annum, and the other party was also to agree to build and operate a street railroad in the city, and where the entire contract was submitted to the voters to be voted on at one time, without any opportunity to vote on the different propositions separately, such submission was illegal.—Americus Ry. & Light Co. et al. v. Mayor, etc., of City of Americus (Ga.), 70 S. 578.

Right of Water Company to Instal Meters on Free Water Service.—The contract between a city and a water supply company permitted the city to maintain service pipes from the mains to obtain water for its public uses, but required the connections to be made under the supervision of the water company, and provided that whatever water was furnished for the city's public uses should be used under reasonable regulations prescribed by the water company, and that water from the city's service pipes should be used only fo rpublic purposes and without waste. The water company refused to permit the city to connect its service pipes to procure water for its sewerage system, unless meters were installed at the expense of the water company. It appeared that the meter systm was the only practicable way of determining whether there was unnecessary waste in flushing them. *Held,* that the water company had the right to require the installation of meters at its own expense as a condition to making the connection, though the city paid a flat rate for water it used; the fact that it might be necessary to place the meters in boxes located near the curbs not constituting such an obstruction as to make the water company's demand unreasonable.—Portsmouth, Berkley & Suffolk Water Co. v. City of Portsmouth (Va.), 70 S. E. 529.

City Not Liable for Injury from Fireworks Set Off Under Authority.—The setting off of fireworks by a municipality, which holds ground for the public as a playground, solely for the public use, is not a nuisance, as the town is not the owner of the playground in the ordinary sense; and, furthermore, the setting off of fireworks on a single occasion does not create any permanent or continuing condition of real estate, and ordinary negligence is not a nuisance. A municipality is not liable for injuries by fireworks set off under statutory authority on a public playground, as it is a public work, conducted solely in the public interest and for the general benefit.—Kerr v. Inhabitants of Brookline (Mass.), 94 N. E. 257.

Liability for Negligence in Sewer Construction—A city authorized to build sewers is not liable for injuries to the property of an individual caused by the construction of the sewer, unless it or its contractor is guilty of negligence, or there is an actual physical invasion of the property. A contractor employed by a city to construct a sewer as authorized by statute and performing the work under the supervision of the city, occupies the position of the city, and is not liable for injuries to the property of an individual in consequence of the construction of the sewer, in the absence of any negligence or an actual physical invasion of the property. A municipal corporation has no greater immunity than a private corporation or person from the consequence of its own negligent or unskillful performance of a lawful work. A city employing a contractor to perform a

lawful work under its supervision or employing an independent contractor is liable for the negligence of the contractor in the performance of his work.—Hanrahan v. Mayor and City Council of Baltimore et al. (Md.) 80 Atl., 312.

Unreasonable Delay in Paving Contract Invalidates Tax Bills.—Where an ordinance for street paving allowed a reasonable time for the performance of the work, the city engineer could not grant extensions, delaying the completion of the improvement beyond a reasonable time. A contract for street paving contemplated that the work should begin in November, and evidence showed that under favorable conditions the work could be completed in a month. No work was done by the contractor until late in April following. There was a continuous period of about three weeks in December in which work might have been performed, and there were other shorter periods during the winter and early in the spring. Held to show as a matter of law a want of reasonable diligence on the part of the contractor, rendering the tax bills invalid on that ground.—Gilsonite Const. Co. v. Field et al. (Mo.) 138 S. W., 676.

Private Sewer Not Ground for Vacating Assessment for Public Sewer.—A landowner who has a private sewer cannot vacate an assessment for a public sewer when benefited thereby because the public sewer did not adopt his own.—Lehigh Valley R. R. Co. et al. v. Mayor, etc., of Jersey City et al. (N. J.) 80 Atl., 228.

Trespass Does Not Invalidate Sewer Assessment.—Although a public sewer was run over private property and its establishment thereon was a trespass, that fact does not excuse a private landowner from special assessments for benefits received therefrom. —Id.

Cost of Repaving Street May Be Assessed. —The liability of abutting property owners to assessment for the improvement of a street is not limited to its original construction, but the cost of repaving, when necessary to keep the street in proper condition, may also be assessed against them as special benefits.—Citizens' Association v. City of Bridgeport. (Conn.) 80 Atl., 203.

Validity of Health Regulations—Bathing in Public Water Supply.—Though a riparian owner's right to the reasonable use of the water of a pond includes the right to bathe and swim therein, such right was not primary, but incidental to the ownership of the land, and hence a regulation of the State Board of Health prohibiting bathing in a pond from which a city derived its water supply was not unconstitutional as depriving a riparian proprietor of his property without compensation and without due process of law, but was a valid exercise of police power. A health regulation, in order to be valid as a proper exercise of police power, in some reasonable degree, must tend to accomplish the result sought, and hence the question of its validity is for the court, though the wisdom or expediency of the measure is for the enacting power. A regulation by the State Board of Health, prohibiting bathing in a pond from which the city obtained its water supply, is valid, though there are other sources of contamination more serious than bathing, which were not affected by the regulation. Regulations for the protection of health are looked on with favor, and every reasonable presumption and intendment is indulged with reference to each element essential to their constitutionality.—State v. Morse. (Vt.) 80 Atl., 189.

Sidewalk Ordinance Must Be Specific as to Necessary Appurtenant Construction.—An ordinance for the improvement of a certain street provided for concrete walks, and that the sidewalk space should be graded by cutting down or filling up the surface of the ground to 14 inches below grade, and that the necessary filling should be done with earth or other material. The ordinance also provided that abutting owners might construct the sidewalk in front of their property if the work complied with the requirements of the ordinance. The objector's property was 9 feet below grade, and in order to construct the sidewalk a retaining wall or an embankment would be necessary. Held, that as the ordinance did not specify how such retaining walls should be made, or of what materials, or whether an embankment should be used instead, the assessment for the improvement provided for in the ordinance was void.—City of Chicago v. Marsh et al. (Ill.) 95 N. E., 473.

Regulation of Street Railways by City Must Be Reasonable.—A city has the right, under police power, to regulate the use of the tracks and cars of a street railroad company in a reasonable manner. The right of a city, by the exercise of its police power, to regulate any business or the use of any property does not give the power to prohibit the conduct of a lawful business, or to entirely suppress the use of property. A city cannot, by mere declaration, show the operation of a street railroad constructed under authority of law to be a nuisance, and subject its tracks to removal, merely because its operation may be dangerous, since the public welfare declares that there should not be a discontinuance of the operation of an authorized railroad.—City of Chicago v. Chicago and Oak Park Elevated Railway Co. (Ill.) 95 N. E., 456.

Contract with City for Indefinite Period Can Be Voided by Later Council.—A council of a municipality cannot make a binding contract by which it undertakes to obligate the municipality to furnish "free of charge," for an indefinite time in the future, sufficient water for the closets in a given building situated within the corporate limits, in consideration of the owner of the building allowing the municipality to lay its sewers through his land. Such a contract, being

ultra vires and void, could not be ratified by the continued use, under the contract, of the sewer through the land by the municipality; nor would the benefit thereby received estop it from subsequently setting up the invalidity of the contract.—Hoskan v. City of Moultrie (Ga.), 71 S. E. 785.

Lands Must Be Appropriated by Ordinance, Not Resolution.—Under the act providing for the formation and establishment of towns, a resolution to pay awards for land damages, the effect of which is to vest the title to the lands to be taken in the municipality, is void in the absence of an ordinance providing for the laying out of the street for which it is necessary to take and appropriate the land. The statute grants to the municipality the power to open streets, and the appropriation of necessary lands; but the power must be exercised by ordinance, and not by a resolution.—Hening v. Town of Montclair et al. (N. J.), 80 Atl. 102.

What May Be Included in Sidewalk Contract.—In assessing for the construction of sidewalks on the principle of actual benefits, the front-foot rule is prima facie an equitable basis of assessment. When such sidewalk improvement involves the destruction of growing trees, and no provision of law exists for the award by the board of assessors to abutting owners of damages therefor, the fact that such damages are sustained will not justify the cancellation of an assessment for benefits for the construction of the sidewalk, even though such damages equal or exceed the benefits. An assessment for a sidewalk improvement, which includes the cost of grading and removal of trees, and divides it on the front-foot basis, instead of requiring the property in front of whch such grading and cutting was done to pay for it, was proper. Even if the grading of a street is a substantial improvement and not incidental to the construction of a sidewalk, under sections 64 and 71 of the town act, both may be included in one ordinance and one assessment.—Worth et al. v. Town of Westfield (N. J.), 80 Atl. 104.

Reconstruction of Bridge Is a Street Improvement.—Under an amendment to the Constitution providing that a city might increase its bonded indebtedness for the improvement of streets, the construction of a bridge in place of a previous bridge, which spanned a river, dividing a city street, is an "improvement" of the street, and bonded indebtedness may be incurred to pay for such improvement.—Bruce v. City Council of Greenville (S. C.), 71 S. C. 817.

Street Railway Company Cannot Retain Unused Tracks if They Constitute a Nuisance.—A railroad corporation, having the special privilege of constructing, maintaining and operating its railroad in the streets of a city, does not thereby acquire the right to maintain a nuisance in the streets, and it has no right to maintain a nuisance for the purpose of preserving a franchise. An adjudication requiring the removal of the rails would still leave the owners of the franchise free to replace the old rails with new, and to operate the railroad. If the claim of nuisance rested upon the mere nonuser of the franchise, a different question would be presented.—City of New York v. Montague et al., 129 N. Y. Supp. 1084.

The LaPorte, Ind., Water Works Case.

The United States Circuit Court of Appeals, Seventh district, has added its decision to those of other courts given in cases arising from the presumed attempt of the city of Laporte, Ind., to purchase a system of water works without the money to pay for it and under a limitation of indebtedness such that bonds could not be issued in sufficient amount to cover the entire cost.

The ordinance which began the proceedings attempted to bind the city to purchase a certain amount of stock in the company formed to build the works with the contractors and the city as the stockholders, and to purchase a definite amount of water per month at a fixed price sufficient to pay all expenses and gradually extinguish the bonds of the company issued to pay for the construction.

Water works had long been established by the city on the bank of Lily lake, within the city limits, and the entire supply for municipal uses and distribution to the inhabitants was drawn from that small body of water and contiguous small lakes; but this water was not potable, and for drinking purposes private wells were the only source of supply. Thus it was well recognized that public supply for domestic purposes from another source was needful, and upon petition of taxpayers the common council had submitted the question of an extension of the water works to that end, for vote by the electors, resulting in a majority favoring such undertaking. Thereupon plans were made and bids taken for extension of the works, but it turned out that the cost thereof, under the lowest bid, was beyond he ability of the city to incur as an indebtedness under the limitation fixed by the Constitution of Indiana. So the scheme involved in the present controversy was adopted.

The Laporte Water Supply Company was incorporated under the general statutes of Indiana—with the members of the firm which had made the lowest bid for the work as incorporators, vested with suitable powers for the undertaking and with $75,000 named as the capital stock, and the provisions of the ordinance were formally accepted by such corporation. It obtained title to the lands referred to outside the city limits for pumping station, wells and pipe line, and constructed the various works and pipe lines provided and intended by the ordinance, both on the above-mentioned lands and within the city, whereby connection with the municipal water works system was established. Thereupon the required supply of potable water was and is furnished for distribution by the city from and through its system. The buildings and machinery erected by the company within the city occupy lands owned by the city for the purposes of its water works, and the engines thereof are supplied with live steam from such works, in conformity with the provisions of the ordinance.

The ordinance was adopted August 7, 1899, for an extension of the water works, of which the cost was named at $97,850. At that date the city was otherwise indebted for an amount which left a margin slightly in excess of $30,000 for which it could occur indebtedness within the constitutional limita-

tion, and the inhibition was plain against contract liability for the cost of such extension. Another ordinance was adopted by the common council providing for an issue of municipal bonds to raise $30,000 to pay for like portion (300 shares) of the capital stock of the water company, and authorizing subscription on behalf of the city for such shares of stock. This fund was raised, paid over to the use of the company and 300 shares of stock were issued and received therefor. Wheeler & Co. (bidders for the work) entered into contract with the water supply company to make the extension provided under the ordinance for $30,000 in cash, $35,000 in stock, together with $60,000 in bonds to be issued by the company, secured by mortgage. Thereupon Wheeler & Co. received the amount paid by the city and the water supply company issued and delivered the mortgage and bonds referred to for use of Wheeler & Co. in performance of the work. These instruments were immediately marketed and the proceeds so used by Wheeler & Co., the bonds in suit being the unpaid portion thereof. The total number of shares of stock issued by the water supply company was 700, and Wheeler & Co. received 400 of such shares, making no cash payment for any part thereof, so that their only contribution to the capital stock was through their performance of the above mentioned construction contract.

Pending proceedings under these ordinances, and prior to the making of the construction contract or execution of the bonds and mortgage in suit, a suit was commenced by one Scott and other taxpayers of the city against both the city and the water supply company and the city officials to restrain issuance of bonds by either party and other proceedings thereunder. This suit resulted in a decree against such defendants.

After completion of the work Wheeler & Co. sold and transferred to the city of Laporte all of their shares of stock in the water supply company for $9,950. On May 2, 1900, "the city of Laporte entered into possession of the property of the water supply company and thenceforth operated it as a part of the water works system of the city." During such occupancy the city paid 12 of the outstanding mortgage bonds so issued by the water supply company, but ceased further payments thereof, when a decision in the above-mentioned Scott case was rendered on its appeal to the Supreme Court.

The property consists of a pumping station and appliances, wells and pipe line constructed by the water supply company on lands owned by the company, not within the city limits, and other works within the city of Laporte, constructed by the company on lands owned by the city for its water works, together with connecting pipe lines and appliances in intermediate highways of the city, for delivery of water from the wells of the company to the system of water works owned by the city, furnishing the inhabitants suitable drinking water, for which the existing supply of the city was unfit. These works were provided under and in conformity with the terms of a purported ordinance adopted by the common council to obtain such supplemental and needful supply of water.

The adverse propositions are as follows:

(1) That the ordinance referred to "was a mere sham, invented by the city officers and Wheeler & Co.," contractors for the work, "to hide the illegality of the transactions, and by indirection do what the laws and Constitution of Indiana prohibited," with "incorporation and use of the supply company" as a mere "dummy."

(2) That an adjudication accordingly, which appears in a suit commenced by taxpayers before the mortgage was made, is conclusive of such invalidity, as against the appellees.

(3) That "the machinery and appliances were put in as an enlargement and extension and as a part of the city water works plant, to be used and are in use by the city, and are not subject to be sold and torn out of the plant."

The mortgagor, Laporte Water Supply Company, is a corporation organized pursuant to the general laws of Indiana for the purposes named in its articles, which embrace the establishment and operation of a "water works system in and near the city of Laporte" and authority "to vend water to the city"; and its incorporation was plainly within the provisions of the statute referred to, conferring the usual powers to acquire, hold and convey corporate property. The contentions, therefore, of want of authority to construct and operate the works described in the decree, must rest on the alleged invalidity of the ordinances referred to and transactions thereunder, and not upon the further objection that the plant thus provided was "merely an extension and enlargement of the city's own water works system," and that the statutes "do not authorize a corporation to be created to operate as a part of" such systems.

The mortgage in suit, covering the plant so constructed, was executed by the water supply company, securing its negotiable bonds, which were marketed and the proceeds applied in performance of the construction contract; and the foreclosure decree involves only disposition of such property. Unless the facts in evidence disprove ownership of this property, in whole or in part, by the mortgagor company and establish ownership in the city of Laporte, as of the date when the mortgage was delivered, we believe the mortgagees to be entitled to the equitable relief awarded by the decree. For reversal, however, the appellant contends, in substance, that the ordinances and proceedings throughout were fraudulent means, devised and carried out between the common council and city officials, as one party, and Wheeler & Co. (bidders and contractors for the work), as the other party, to build the works for and on the credit of the city—in violation of the constitutional provision against incurring municipal indebtedness—with the water supply company incorporated and serving as a cloak or dummy for the city and having no actual interest in the undertaking, and that such fraud and invalidity are established, either (a) res adjudicata, in the case of Scott v. City of Laporte et al., or (b) under the undisputed circumstances in evidence. Thus the issue raised is not whether the ordinance provisions are enforceable against the city, nor whether the proceedings referred to were invalid in so far as they attempted to impose obligations upon the city, but it is limited to the inquiry whether contract relations and collusion between the parties to the undertaking are established, which affect and invalidate, in whole or in part, the mortgage of the plant, so issued by the water supply company.

The defense of res adjudicata rests on the decree obtained by Scott and other taxpayers in their suit against the city of Laporte and executive officials thereof and the water supply company, which was commenced August 26, 1899, after the adoption of the ordinance and before the water supply company let the contract for the work or made the mortgage involved in the present suit.

An application for an injunction pendente lite was denied, both classes of bonds were issued, and the work was completed. Subsequently the complaint was amended, stating further facts tending to show that the city was to become the owner of all the stock issued by the supply company, and a supplemental complaint was filed, charging that the arrangement was carried out, by issuance and sale of both classes of bonds and

by taking over by the city of the stock issued to Wheeler & Co., with the supply company serving as a cloak or dummy for the city to incur the mortgage indebtedness.

The judgment rendered on a second trial of the case declared:

It is therefore considered and adjudged that the ordinance of defendant city of August 7, 1899, referred to in the complaint and findings herein, is null and void; that the defendants, their officers, agents and servants, and each of them, be and are hereby severally, perpetually enjoined from paying or making any payments upon, or appropriating, demanding or receiving money for the payment of, the bonds or interest thereon of the Laporte Water Supply Company, described in the finding and being an issue of $65,000.00 par value, or the debt thereby attempted to be secured; and that said defendant city, its officers, agents and servants are hereby further perpetually enjoined from granting, giving or paying any money or thing of value to, or placing any of its funds at the disposal of, or paying any bills incurred, audited or authorized by the defendant Laporte Water Supply Company or its officers, agents or servants; and said defendant Laporte Water Supply Company, its officers, agents and servants are enjoined from in any manner making any demand upon the defendant city for money, property or thing of value whatsoever.

As the mortgage was issued by the water supply company after the litigation was commenced, the mortgagees were alike concluded thereby, under the common-law doctrine of lis pendens, unless their interest is exempt from such rule, either through the statutes of Indiana providing for lis pendens notice, or through the recognized exceptions from the rule at common law. This exemption is denied after detailed argument and citations.

The effect of invalidity of the ordinance under which the plant was constructed, in reference to the relief sought and granted against the mortgaged property, remains to be ascertained. The plant is unitary in respect of its construction and service, as an auxiliary means of water supply for the pre-existing water works system of the city. For the present consideration, however, it requires apportionment into two parts. The engines, structures and water pipes within the city are affixed to real estate either owned by the city or constituting highways thereof, with no property right in such real estate vested in the mortgagor company, otherwise than through the invalid ordinance. On the other hand, the wells, pumps, water pipes and other structures outside the city are located on lands purchased and held in the name of the mortgagor company, so that title to such portion does not rest on any grant or provision of the ordinance, although constructed and placed in conformity with its purposes.

1. In reference to the property within the city: The mortgager entered as a party to the collusive arrangement between the assumed representatives of the city and the bidders for the work, for adoption and acceptance of the ordinance, all having actual or presumptive knowledge of the facts which rendered such action on the part of the city officials both unauthorized and void. Therefore, neither the mortgagor nor the mortgagees chargeable with notice have equities in the premises to authorize the decree in their favor.

The insidious method which ultimately appears in the scheme for vesting in the city all property rights in the plant as an equity, through its ownership of all the capital stock, marks the entire transactions as violative of the constitutional provision, alike with various methods of direct conveyance to the municipality of such property, subject to a mortgage, which are thus condemned by the authorities above referred to. But assuming that the mortgagor, water supply company, incorporated between such parties to issue the stock and hold the property thereunder, thereby becomes a party, alike subject to condemnation and disability, its exclusive corporate ownership and possession of the real estate, wells and fixtures in question could not be disturbed and taken, either in law or equity, for the benefit of the city. Whatever may appear to be the present relation and status of the mortgagor in the premises, however, the mortgagees are entitled to foreclosure relief in respect thereof, as granted by the decree. While they are bound by the adjudication against the validity of the ordinance, as unconstitutional in its purpose, and are thus left without title or equity in the property within the city predicated thereon, their rights in the other portion do not rest in any sense upon the ordinance. The real estate was purchased from the several owners for the water supply company, and the title stands so vested in the mortgagor, with no right or interest possessed by the city, legal or equitable, apart from such rights as may be conferred by its purchase and ownership of the corporate stock; and the wells, pumps, pipe lines and other fixtures were provided and placed thereon by such owner of the fee. So the complete property right thus vested in the mortgagor was conveyed under the mortgage, and the recording acts protect the mortgagees from adverse claims, except to the extent of the lis pendens notice. Neither that notice nor the ultimate decree therein purports to set aside the title thus acquired, and no disturbance thereof was made by the decree, beyond its injunctional provisions against payment by or demand of the city on account of the bonds and mortgage, and other liabilities attempted to be imposed.

It is true that both portions of the works were provided in conformity with the purposes of the ordinance, to be united for an auxiliary water supply to the city system, and that each became useless for such object when severed, so that both depreciation of their value and loss to the city of such means of water supply must result from severance, while the city is forbidden to contract for purchase or use of that source of supply. The city cannot, directly or indirectly, be charged with liability to take and assume payment for works so provided by the unlawful scheme entered into between its officers and the contractors, but, without other equities than appear in the record, sequestration or other taking of this portion of the works from the mortgagees, for the benefit of the city, would be inequitable and unauthorized. The amount paid in by the city was within the constitutional limit, although the purpose was adjudged unlawful. If entitled, in any view, to be made an equitable lien or charge upon such portion, as against the mortgagor, it was not so made under the lis pendens, and the mortgagees (and bondholders) acquired the title without notice thereof otherwise. Therefore, the decree rightly grants foreclosure relief in respect of the property so held outside the city of Laporte.

Judge Baker dissents from the opinion of the court, believing that the water works plant is not separable into the two parts, and that the city should be left in possession of the entire property and should not be required, as the decision practically demands, to save the money which it has already paid into the scheme by purchasing at a price which it cannot fix, the portion outside the city limits.

FIRE AND WATER

The Value of Motor Fire Apparatus.*

BY LOUIS BEHRERS, CHIEF OF CHARLESTON, S. C., FIRE DEPARTMENT.

In discussing the use of motor fire apparatus I shall not dwell on the merits of any particular make, or the superiority of one design over another, but would suggest that only machines of sufficient horsepower, not less than ninety for fire engines and not less than sixty for combination wagons and chemical engines, be selected. The more horsepower a machine has, the more efficient work will it accomplish. There is no question that the motor engine has many advantages over the horse-drawn apparatus, and I wish to emphasize some of these advantages that occur to me as most worthy of consideration.

The first to be considered is the high speed of the motor apparatus in reaching fires. This is very important. Soon after Charleston's motor fire engine was commissioned came the first opportunity to test its speed efficiency and superiority under practical conditions. On the night of October 25, 1910, a one-story warehouse of the Atlantic Coast Line Railroad Company, a building of an area of 50x200 feet, with inflammable contents, took fire, the flames gaining considerable headway before the alarm was sent in, and being a mass of fire when the first apparatus arrived. Almost adjoining this shed, and distant by the width of a street, were the large freight depots, filled with cotton, hay and other combustible materials. In this street was also a box car loaded with cartridges and powder. The eaves of the depot were catching and the sides of the car were ablaze when I reached the scene simultaneously with the motor fire engine. This engine took the hydrant about fifty feet from the burning building, connections were made and the hose run out almost instantly. With the turn of the lever the motor was connected with its pump and two strong streams were soon playing on the igniting depot and burning car, which were saved by this promptness, for in three or four additional minutes, when the steam engines began to play, it would have been too late, and the property damage would have been very great.

The second advantage which comes to mind is the ability of the motor fire engine to answer any number of alarms coming in close succession. Whereas, with the horse-drawn apparatus, a succession of alarms is nothing short of a calamity. Two or three alarms in close succession impose a great strain upon engine horses, which are generally exhausted by the third call, and can not render adequate service.

A third striking advantage of the motor engine is its ability to throw water with almost no loss of time. On arriving at a fire it is ready for use, regardless of the distance traveled, whether long or short. The man who drives the motor is engineer and stoker as well. As soon as connections are made at the hydrant the motor is ready for pumping water under any pressure desired, and maintain a uniform stream for an indefinite period. Consequently, in a majority of instances, where there is a motor engine used with steamers, the motor machine will throw from 1,000 to 2,000 gallons of water on the fire before serviceable streams can be gotten from the steamers, and that supply of water will often hold in check most effectively a blaze until steam engines arrive with reinforcements.

The question naturally comes up, "What is the life of a motor fire engine?" It is not yet practically determined. But it may be fairly estimated. The average fire apparatus will travel approximately from 250 to 300 miles in a year in cities of about 60,000 population, or nearly 6,000 miles in twenty years; while the motor apparatus, not being taken out to "exercise" twice a week, travels from 120 to 150 miles a year. Not only that, but to estimate from a ten-year average of the steamer's fire pumping, I figure out that a motor fire engine will have to pump for only about ten hours per year, therefore, judging from the mileage and endurance of the touring car which I use in responding to alarms, inspecting buildings, visiting fire stations, etc., a car yet giving excellent service, which has traversed 4,500 miles in the past year, and fully 17,000 miles in the past four years, I see no reason, as the motor apparatus is constructed along lines for practical fire service, and is built much stronger than the average car used by chiefs, why the motor apparatus should not, with no more repairing than the ordinary steam apparatus, serve effectively for ten or fifteen years. This is an estimate which I make from practical observation.

The Charleston department has used a motor fire engine for over nine months with

*A paper before the South Carolina State Firemen's Association.

satisfactory results. This engine was built by the Webb Motor Fire Apparatus Company, and is a ninety-horsepower, six-cylinder Thomas motor machine, equipped with a rotary pump of a capacity of 800 gallons per minute at plug pressure; it carries a crew of eight men, 1,000 feet of hose, axes, ladders, extinguishers, pipes, etc., and has been in commission since October 1, 1910. It has not failed to respond to any fire, and has answered sixty-six alarms and traveled ninety-three miles, pumping at fires nine hours and fifty-one minutes. The cost to maintain this machine, for gasoline, cylinder oil, grease, spark plugs, recharging storage batteries, etc., has been $52.10, or 19 cents a day. The tires show no material wear, and have yet to experience their first blowout or puncture.

To accomplish this motor engine's work for nine months, using horses, would require four animals, which cost to maintain, for oats, hay, veterinary services, harness repairing and shoeing, about $15 per month per horse, a total of $540 for nine months. Coal for boiler would cost $15 per month, or $136 for nine months. This means a maintenance cost of $675 for the steamer. Comparison shows a saving to the city of Charleston of $622.70 in nine months in the use of the motor apparatus.

We also save the salaries of two drivers, one on the steam engine and one on the hose wagon, and of a stoker, at $65 per month each, or a total of $1,755 for nine months. Of the four engine and hose wagon horses, worth $300 apiece, one is lost by death, accident or unfitness for service every three or four years, making an additional cost of $100 per year. In comparison of totals for nine months' use of two types of apparatus there appears a balance in favor of the motor engine of $2,447.90 in nine months, or $3,303.72 in a year. Think of a saving like this in nine months, and you can not but agree with me that the motor apparatus is wonderfully economical. I have not in my comparison of maintenance cost included repair expenses for either apparatus, estimating that this item of upkeep will average about the same for each.

While the first cost of the self-propelled apparatus is greater than that of the horse-drawn equipment, the difference is made up in a short time after purchasing the motor engine by low maintenance and operating expense. Yet it appears to me that the economy of the motor engine is a minor argument in its favor, for, after all, it is efficiency we want, and I believe that you will all concede that quick action is the most essential feature in fire fighting, and when we take into consideration the fact that the motor apparatus will make a run in less than half the time required by the steam engine, then it is that its real value comes home to us.

With these advantages of the motor fire engine in view, not to mention others that could readily be cited, when we consider its facility for speedy response to alarms, its ability to respond to any number of alarms in close succession, its quick water-throwing power, and its capacity for long service, we can but feel compelled to advise the installation of one or more pieces of auto apparatus by every fire department.

I would advise cities planning to place motor apparatus in their fire departments to station this apparatus along with the horse-drawn equipment in the congested business districts, and have it respond to some of the calls from the outskirts as well. That method is the quickest and best way to try the auto engine out and to overcome any difficulties that experience might anticipate.

And now a word about the care of the motor engine. Proper lubrication is one of the most essential factors for good service. The very best lubricants should be used, care being taken that the engine oil contains as little carbon as possible, a result obtained principally by filtration. The transmission oils and grease for the running gear should be free from acid. Strained gasoline of the best quality should be used, for the cheaper grades produce carbon. The tires should be given the best of attention, and be kept properly inflated at all times, cuts being treated with cement preparation, as this adds to the life of the tires, which, when properly inflated, are less susceptible to punctures.

Driving a motor engine at a speed greater than twenty miles an hour through city streets does not pay, as the small amount of time saved by fast driving does not warrant the risk of accidents incurred. In regard to the men who handle the engine, I have found that it does not require experts. Any cool, sober man, with ordinary common sense, and with some knowledge of machinery, can learn to drive and operate a motor engine with the training of some two or three weeks.

In conclusion, I wish to say that I feel that Charleston is well pleased with the motor fire engine. As a matter of fact, I have recommended that our city order a motor combination chemical and hose wagon in the near future. But the motor apparatus has not reached its fullest development, as a matter of course. The motor fire engine pump, as constructed today, while giving excellent service and no trouble, can, I believe, and will be improved upon shortly, so that the water-throwing capacity of the motor engine will compare favorably with a first-size steamer. Manufacturers of fire apparatus in this country have been watching carefully the progress of the gasoline motor fire engine for the express purpose of introducing this type of apparatus into fire departments, and they will no doubt soon see that the pump is brought to its proper power. I would advise you not to discard steam engines, but to keep them all, and as soon as opportunity offers, to put in one or two pieces of motor apparatus, and give the auto engine type a fair trial, arriving at your own conclusions as to its value.

ROADS AND PAVEMENTS

Proposed Interstate Roads.

Sidney Suggs, State Highway Commissioner of Oklahoma, is reported to be locating through his State a section of a continuous good road from Galveston, Tex., to Winnipeg, Man. The Oklahoma counties on the line have located their portions of it and will concentrate funds on its improvement. Winfield and Wichita, Kas., are on the proposed line, and county commissioners are raising money, Cowley county levying a one-mill tax, which will raise $49,000 a year. Texas counties are considering routes, but have not yet taken definite action.

A conference of prominent citizens and state officials of New York, Massachusetts and Connecticut, including a tour of inspection, is to be held with the idea of unifying the plans for roads of the three States so that they will connect with each other.

Highway Commissioner Bigelow of Pennsylvania proposes to build that State's section of the Lincoln Memorial road from Washington to Gettysburg at once, the surveys having already begun. The old National road from the Maryland line near Somerset to the West Virginia line near Wheeling will be built this year, some $300,000 or more to be spent ultimately upon this road.

The Georgia-Alabama Good Roads Association has been formed to promote a highway from Atlanta to Mobile, nearly all of which has been located. The road will connect with the Atlanta-Chattanooga road and the National road promoted by the Atlanta Journal and the New York Herald.

The "Florida Direct" highway has been located from Jacksonville, Fla., through Augusta, Ga., and Columbia, S. C., to Charlotte, N. C., where it connects with the National highway above mentioned. Strong efforts will be made to secure improvement by the local authorities of the portions of the line most needing it. The length of the road from Jacksonville to Charlotte is 463 miles. Signs will be placed on the route in November. A company has been formed to build a bridge over the Altamaha river.

Florida counties are improving their sections of the national highway above referred to, which was located some time since. Duval county has let a contract for 17 miles of sand-clay road on the line at an average of $1,070 a mile, with extras for clearing, grubbing and grading. Three and a quarter miles of the road near Jacksonville toward St. Augustine are being paved.

A map prepared by the Office of Public Roads merely for the purpose of gauging the extent of the good roads movement as fostered by individuals, associations and communities, shows the following great highways in contemplation or actually under construction:

From Yellowstone Park to Glacier National Park, through Fort Yellowstone, the Big Hole battlefield and other interesting points in the Rocky mountains—a total distance of 450 miles.

The Pacific highway from Vancouver, B. C., to Tijuana, Mexico, a distance of 2,009 miles.

The Memphis-to-Bristol highway, connecting Knoxville, Nashville and Jackson, a distance of 540 miles.

The Lincoln Memorial road, from Washington to Gettysburg, 40 miles.

The Sherman, Tex., to Galveston highway, 150 miles.

The Central highway, from Morehead City, N. C., on the Atlantic ocean, to Paint Rock, on the French Broad river, Tennessee, through Goldsboro, Raleigh, Greensboro, Salisbury, Charlotte and Asheville, N. C., 460 miles.

The Dupont highway, from the upper to the lower end of Delaware, proposed by T. Coleman Dupont, who has offered to advance $1,000,000 towards its construction; length of route, 103 miles.

The Des Moines-Kansas City and St. Joseph trail.

The Ocean-to-Ocean highway, extending from Cumberland, Md., to Tacoma, Wash., passing over the old Cumberland road, through Columbus, Indianapolis, St. Louis, over Boone's Lick trail, and St. Louis to Old Franklin, Mo., through Nebraska, Wyoming, Idaho, Oregon asd Washington; length of route, 3,800 miles.

The Montreal to Miami highway, passing through Albany, New York, Trenton, Philadelphia, Baltimore, Washington, Richmond, Raleigh, Columbia, Savannah and Jacksonville.

The Lincoln way, from Louisville to Nashville, 150 miles.

The Capital to Capital highway, extending from Washington, D. C., to Jacksonville, through the capitals of the seaboard States; length of route, 1,500 miles.

The Clay-Jefferson Memorial highway, from Niagara Falls to New Orleans, via Zanesville, Ohio; Maysville, Ky.; Nashville, Tenn., and Meridian, Miss.; 1,200 miles.

The "Red to Rio" highway, from Denison, Tex., to Dallas, Waco, Austin and San Antonio, connecting Houston and Galveston; 600 miles.

Another proposed Lincoln Memorial road would run from Washington to Richmond, Va., but has not yet received enthusiastic support.

St. Johns, Baker and Columbia counties are slowly getting their sections into passable shape.

STREET · LIGHTING

Manchester Gas—Milwaukee Gas.

Manchester, England, Municipal Gas Supply.

The annual working report of the Manchester municipal gas department has just been issued and records the fact that although the price charged for gas used in the city was the lowest ever imposed, the net result has been the highest profit on record.

The quantity of gas transmitted from the works showed an increase of 98,156,000 cubic feet, or 1.76 per cent., as compared with a decrease of 73,037,000 cubic feet, or 1.29 per cent., in the previous year. The number of gas consumers on March 31, 1911, within the city was 170,693, or 2,634 more than in the preceding year, while the number of consumers outside the city was 10,663, against 10,431 in 1910, the total increase for the year being 2,866.

The number of automatic meters in use at the end of the financial year was 63,663, as compared with 61,046 in the previous year, of which increase 2,473 have been placed in the city and 144 in the out townships. The quantity of gas passed by these meters was 590,062,000 cubic feet, an increase of 50,305,000 cubic feet over the previous year. These automatic meters were inspected once in every five weeks, and the amount collected from them during the year was $398,059. This amount is represented by 19,630,986 pennies (penny, 2 cents), weighing over 175 long tons.

The number of gas cookers owned and fixed by the gas department of the city was 53,730 on March 31, 1911, as compared with 49,948 for the year ended March 31, 1910. It is estimated that the quantity of gas consumed by these gas cookers in 1910 was 695,000,000 cubic feet, an increase of 39,000,000 feet over the previous year's figures. The gas department has also fixed 30,831 grillers in connection with the automatic and small ordinary meters. About 46 per cent. of the consumers now have the free use of a cooker or griller.

On March 31, last, the number of gas engines in use was 1,573, as compared with 1,613 in the previous year. The quantity of gas consumed by these engines was 380,994,000 cubic feet, an increase of 2,352,000 cubic feet.

In accordance with a resolution recently passed by the Manchester City Council the price charged for gas used within the city for manufacturing purposes only will be reduced from 55 cents to 49 cents per 1,000 cubic feet after June 25, 1911, provided the annual consumption is not less than 500,000 cubic feet. The quantity of gas supplied to automatic meters for 1 penny (2 cents) will be increased after September 30 from thirty to thirty-three cubic feet within the city and from twenty-five to twenty-eight cubic feet outside the city.

The gross profit on the year's working was $925,223, of which sum $225,008 was paid for interest on loans, leaving a net profit of $700,215. Of the latter amount the gas department paid over to the city fund for the relief of the city rates the sum of $226,292.

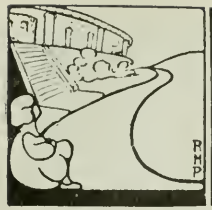
The total length of mains now laid is nearly 948.5 miles, an increase of almost 11 miles during the year. The number of public lamps within the city is 20,357, while outside there are 1,332. The incandescent system of lighting has been applied to all the lamps within the city, and the number of burners fixed thereto is 25,993.

High-pressure lighting has been installed in one of the sections of the city during the past year, and twenty-two lamps, each of 1,500 candlepower, have been fixed. This system of lighting is likely to be extended in the near future in the shopping quarters of the city.

Milwaukee Gas Rate Reduced.

Milwaukee gas consumers are said to be profiting to the extent of approximately $500 a day or $15,000 a month by new meter rates, involving a reduction from 80 to 75 cents per 1,000 cubic feet, according to officials of the company, who state that all bills rendered in August for July consumption of gas are being sent out under the new schedule.

The valuation of the company for taxing purposes was raised by the assessor from $6,000,000 to $10,750,000, and the company has successfully resisted an attempt to raise it another $3,000,000



ORGANIZATIONS & INDIVIDUALS

American Association for Highway Improvements—American Society for Municipal Improvements—League of American Municipalities—Technical Associations—Personal Notes.

American Association for Highway Improvement.

The first annual convention of the American Association for Highway Improvement will be held at Richmond, Va, November 20 to 24, 1911. The first meeting, at which President Taft will speak, will be held in the city auditorium, which has a capacity of 4,000 persons. Other meetings will be held in the auditorium of the Jefferson Hotel, 1,000 capacity.

The first day will be called National Day and in addition to President Taft's address there will be a number of speeches by railroad presidents and others of national prominence.

The second day will be Highway Engineers' Day. It will be given over to technical papers by men who lead their field in some specialty. Mr. Harold Parker of the Massachusetts Highway Commission will preside. Discussion of papers will be limited to five-minute speeches. Publication of papers and discussion will probably be made.

The third day will be Road Users' Day. It will be devoted to traffic regulations, national, state, county and city, and will deal with the question from the standpoint of all classes of traffic. Automobile regulations will be discussed.

The fourth day will be Association Day. The business meeting will be held, election of officers, etc. The affiliated organizations will be given a hearing.

The speakers include President Taft, President Logan Waller Page, Dr. Walter Page, President W. W. Finley of the Southern railway, Chairman B. F. Yokum, of the 'Frisco Lines, President W. C. Brown of the New York Central lines, Chairman Harold Parker of the Massachusetts Highway Commission, Gen. T. Coleman DuPont, Senators Martin and Swanson of Virginia, Congressman J Hampton Moore of Pennsylvania, the leading highway engineers of the country and others.

Among the organizations prominently identified are the Capital Highway Association, organized to build a highway from Washington to Atlanta; the Virginia, Indiana, Ohio, Tennessee, North Carolina and other state associations, etc.

The Touring Club of America is arranging tours from all of the larger cities. Special route cards, pennants, etc., will be furnished. The Capital Highway Association, Leonard Tufts, president, is arranging a tour from Atlanta to Richmond. G. A. Seward, chairman of the Canadian commission, and H. D. Hadley, chairman of the New York commission of the Quebec-Miami road project, are arranging a tour from Quebec via Montreal, Toronto, New York and Philadelphia, to concentrate with the eastern tour at Washington and proceed to Richmond. The southern tourists will meet at Atlanta and proceed to Richmond.

At a meeting held at the Hotel Belmont, New York, on August 17, and attended by representatives from forty road material and machinery manufacturers, the question of a machinery exhibition was discussed. They signified their willingness to provide exhbits if the association so desired in order to evidence their entire sympathy with the movement. President Page stated that the association would abide by the decision of the majority as to the advisability of an exposition, and it was unanimously decided not to provide a machinery exhibit. A resolution was adopted recognizing the association and a committee of six, with Secretary Pennybacker ex-officio, was appointed to work out a plan whereby the manufacturers may aid the association and evidence their support. It is probable that the manufacturers will hold a meeting in Richmond during the convention.

The Permanent International Association of Road Congresses, with headquarters at Paris, in which thirty-five governments are officially represented, has designated the association as its representative in the United States.

American Society of Municipal Improvements.

The annual convention of the American Society of Municipal Improvements will be held in Grand Rapids, Mich., September 26 to 29. The usual delay in announcing the program prevents publication in this number of the subjects to be discussed and the authors of papers.

The committee on standard specifications is active and has announced a meeting of the general committee and of the sub-com-

mittees on Monday, September 25, at 10 a. m., to which it is inviting the members of the corresponding committees of the Association for Standardizing Specifications with the purpose of furthering the expressed desire of members of that organization to attempt uniform reports to the two conventions. Others interested in the subject are also invited to be present at this preliminary meeting. Charles Carroll Brown, Indianapolis, Ind., is chairman of the general committee on standard specifications, having been appointed to fill the vacancy caused by the resignation of City Engineer Rust of Toronto to attend to his newly imposed duties as president of the Canadian Society of Civil Engineers.

Fred Giddings, Atchison, Kas., is the president of the American Society of Municipal Improvements and E. H. Christ is the vice-president representing the city of Grand Rapids, and in charge of the local arrangements.

The municipal officials among our readers who are not already members of this organization will find the convention well worth the time and money expended in attending it.

League of American Municipalities.

The fifteenth annual convention of the League of American Municipalities will be held at Atlanta, Ga., October 4, 5 and 6, 1911. Following is the preliminary program:

Address of welcome by Courtland S. Winn, Mayor of Atlanta.

Response and president's address by Darius A. Brown, president, and mayor of Kansas City, Mo.

"Long Time Bonds for City Improvements," by T. C. Thompson, mayor of Chattanooga, Tenn.

"Law Enforcement," by Marcus B. Cullum, mayor of Duluth, Minn.; Thomas Maloney, mayor of Council Bluffs, Iowa.

"Municipal Insurance Bonds," by Wilson J. Vance, secretary to the mayor, Newark, New Jersey.

"The Future City," by Samuel Carlson, mayor of Jamestown, N. Y.

"City Government by Commission," by Ford H. McGregor, Municipal Reference Bureau, the University of Wisconsin, Madison, Wis.

"The Board of Public Welfare of Kansas City, Mo.," by Jacob Billikopf, member of the Board of Public Works, Kansas City, Mo.

"What a Live City Can Do Under an Antiquated Charter," by J. C. Haynes, mayor of Minneapolis.

"Municipal Government, Its Needs and Requirements," by J. J. Keeley, alderman, Jackson, Mich.

"The Standardization of Municipal Business," by Fred H. Cosgrove, comptroller of Omaha, Neb.

An address by R. G. Rhett, mayor of Charleston, S. C.

John MacVicar, Des Moines, Iowa, is secretary.

Technical Associations.

The next meeting of the National Municipal League will be held in Richmond, Va., in November.

The St. Paul Association of Commerce is a combination of four organizations in various business promotion fields, made to eliminate duplication of efforts and concentrate upon the public work of the city. Joseph H. Beek, 237 Endicott building, St. Paul, Minn., is the general secretary.

State Highway Commissioner James R. Marker, of Ohio, reports that the United States Office of Public Roads made an exhibit of good roads construction at the State Fair in Columbus during the week of August 28 similar to that carried on the good roads train equipped by that office.

The Pacific Highway convention met in Portland, Ore., August 4 and 5. Governor Hay, of Washington, and Governor West, of Oregon, were prominent speakers.

The League of Wisconsin Municipalities held its annual convention in Superior the last week in July. Sewage disposal was discussed by Prof. Geo. J. Davis, of Madison; oiling streets, by City Engineer John F. Icke, of Madison, and there were other papers on general municipal subjects. The delegates inspected the water works plant of the Superior Water, Light and Power Company, and spent an afternoon visiting the industries of Duluth, Minn.

The National Conservation Congress to be held in Kansas City, Mo., September 25 to 27, promises to pay more attention to the engineering features of the work than have past congresses.

The American Association of Park Superintendents held its annual convention in Kansas City, Mo., August 8 to 10. Boston was chosen as the next place of meeting. W. H. Dunn, of Kansas City, was elected president and F. L. Mulford, of Washington, D. C., secretary.

The eleventh annual convention of the Union of Canadian Municipalities is held in Quebec, August 29 to 31. The principal subjects for discussion are town planning, special functions of a provincial capital, profitable destruction of garbage, conservation of water and water power, reinforced concrete water and sewer pipes, county roads and highways, need of expert experience in city government, each being divided into subtitles. W. D. Lighthall is secretary, Montreal, Can.

The International Municipal Congress and Exposition opens September 18 in the Coliseum and First Regiment Armory, Chicago, and continues for the remainder of the month.

The Illuminating Engineering Society is

to hold its annual convention in Chicago on September 25, 26 and 27. This society holds monthly section meetings in New York, Boston, Philadelphia and Chicago, and this is the first annual meeting to be held in the last named. About one-third of the membership is connected with the gas industry and the high order of the papers presented on this phase of lighting will undoubtedly be equaled if not surpassed at this meeting.

At the August meeting of the American Society of Engineer Draftsmen, New York, J. N. Mulder, of Amsterdam, Holland, read a paper on "Internal Combustion and Steam Engines." The society now has a grade of affiliate as a step toward full membership.

The Chicago Gas Rate.

The report of the committee appointed to investigate the cost of making gas in Chicago, reviewed at some length in "Editorial Comment," fixed upon 77 cents as a fair rate for gas, as shown by the data gathered for the period up to and including 1909.

The city council, however, believes that the rate should be still lower and has passed an ordinance fixing the maximum net rate at 75 cents for the first year, 70 cents for the second and third years and 68 cents for the fourth and fifth years covered by its provisions. The past rate has been 85 cents. The gas company asked the circuit court for a restraining order to prevent the enforcement of the new rate for the first year of 75 cents, which would have become effective August 10. This order the court granted, but also ordered the company to charge 80 cents for gas, this order to go into effect August 7. This rate was fixed by the judge and he refused to impound the 5 cents difference between this rate and the ordinance rate of 75 cents pending the decision of the case. Both city and company enter objections to the procedure of the judge, the latter because it reduces the rate and the former because it does not reduce it enough. Both deny the right of the judge to fix the rate at other than their figures until the case is finally decided.

Cost of Lighting Marietta, Ga., Increased.

The Georgia Railroad Commission has passed an order fixing a scale of prices to be charged by the Kenesaw Paper Company for lighting the streets of Marietta by the month.

The monthly rates fixed by the commission follow:

Arc lights	$5 60
Incandescent (60 candlepower)	2 00
Incandescent (32 candlepower)	1 00

The rate for the arc light is the same as charged by the company on yearly contracts. The rate for the 60 candlepower incandescent light is an increase of $1.00 per month, and that for 32 candlepower incandescent lights is an increase of 50 cents a month.

Personal Notes.

A. P. Hartman is chief engineer of the Bronx Valley sewer with offices in Yonkers, N. Y.

H. R. Safford has become chief engineer of the general contracting firm of George B. Swift Company.

Clarence Goldsmith is retained by Boston, Mass., on the new high pressure water service for fire protection.

Arthur M. Hood, Indianapolis, Ind., announces the association with him in the practice of patent law of George B. Schley.

H. E. Riggs, of Riggs and Sherman, Toledo, O., has been retained by Savannah, Ga., to make a valuation of the street railway system.

George Souers has been appointed superintendent of the water works plant at New Philadelphia, O., in place of N. W. Ramsey, resigned.

Albert T. Witbeck has resumed private practice in highway engineering at Brookhaven, Miss., having resigned his positon as county engneer.

E. G. Manahan and Thomas C. Atwood have been put in charge of the filtration plant to be constructed for treating the Croton water supply.

Ray Palmer will make tests for Mayor Harrison, of Chicago, Ill., to determine the best method of preventing damage to water pipes from electrolysis.

Fred D. Strong has been promoted division engineer of the fourth division, New York state highway department, succeeding F. W. San, who resigned on account of ill health.

Wm. Paul Gerhard, consulting hydraulic and sanitary engineer, New York City, has received the honorary degree of doctor of engineering from the Technical University of Darmstadt, Germany.

T. L. Holleran, of Indianapolis, Ind., has been added to the traveling force of the Troy Wagon Works Co., of Troy, O. Mr. Holleran is one of the best known men in the field as a superintendent of steam shovel work.

John Kenlon, acting chief, has been made chief of the Manhattan fire department to succeed Edward F. Croker, resigned. Mr. Kenlon's rank was highest in the civil service examinations, but differed very little from those of two others of the ten deputy chiefs who took the examination.

George L. Watson recently chief engineer of the United Paving Co. Atlantic City opens an office September 1, in the Land Title Building, Philadelphia, for practice as a consulting engineer for contractors on estimates and bids, and construction work generally.

Dr. C. O. Probst, for twenty-five years secretary and member of the Ohio state board of health, who has given that board the highest position in its field, has resigned, it is said, because he is no longer permitted to continue his excellent work in the lines which have proven so successful

The report of Arthur H. Blanchard, who represented the United States government at the recent Brussels Road Congress, has prepared a comprehensive report which contains information regarding his observations of European road practice. The report is at present in the hands of the printer.

Advertisements have been issued for the letting of the first of the roads to be constructed under the new Pennsylvania highway act. A complete reorganization of the department is being effected under the direction of Edward M. Bigelow, recently appointed commissioner of highways. A statement of the expenditure of the $5,000,000 appropriation, under the new law, is being prepared.

MACHINERY AND TRADE

Gas Producers and Gas Pumping Plants at Manchester, Mass.

The village of Manchester, Mass., has what is probably the most complete water supply system possessed by any town of its size in the country. This village is surrounded by many beautiful hills, on the tops of the highest of which some of the handsome residences of the neighborhood are located.

In order to supply the top floors of such houses with ample water pressure and to provide for the future erection of residences on the other hills, a radical change in the supply system of the village was decided upon, and about two years ago the old plant, which was many times taxed to the limit of its capacity, was replaced.

The old plant consisted of boilers and steam pumps, which forced the water from nearby driven wells to a standpipe located on a hill about 180 feet above the station. This furnished ample pressure for the lower sections of the town, but the second floors of the houses located on the higher hills could be assured of but an intermittent supply of water at the best. In addition to this, during the dry season, the wells were taxed to their utmost capacity, and it was evident that an additional source of water supply, as well as a pumping plant of greater capacity, would be necessary.

A small body of water known as Gravel Pond was selected as the source of new supply, and here the Gravel Pond pumping station was erected.

The equipment of the station consists of two Goulds' power pumps, double-acting triplex, 9x12 inches, each having a capacity of 1,000,000 gallons in 24 hours. Each pump is driven by a three-cylinder, four-cycle gas engine, developing 65 brake horsepower at 260 revolutions per minute. The gas for each engine is obtained from a suction producer, which uses either anthracite or bituminous coal.

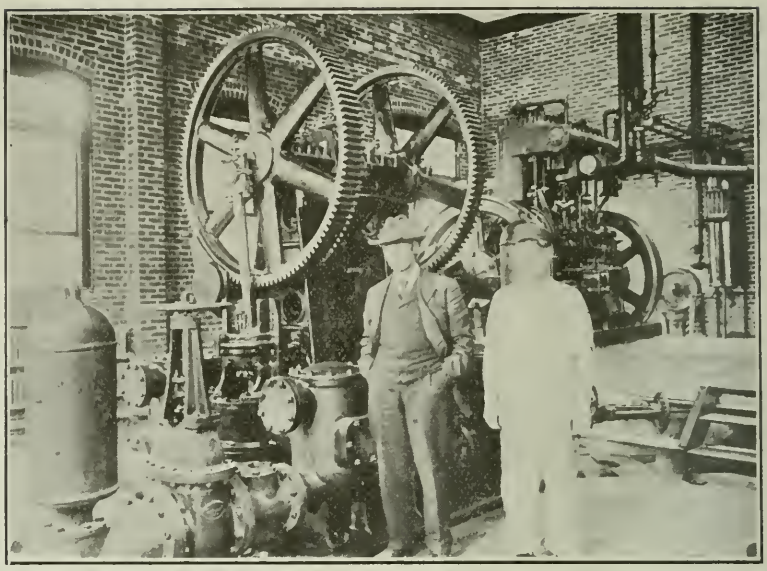
Full descriptions of the gas engines and the complete pumping plant will be found in MUNICIPAL ENGINEERING, vol. xxxix, p. 389, and vol. xl, p. 194.

Superintendent Andrews reports that during the year ending February 1, 1910, there have been pumped at the Gravel Pond station 60,578,000 gallons of water, with an attendant coal consumption of 58.485 tons. This approximates 1,035,700 gallons of water pumped per ton of coal. Although some of this water was pumped into the old standpipe against an average discharge head of 125 feet, the great majority of it was forced into the upper tank against an average discharge head about 75 feet greater, and it may be assumed that practically all of the pumping was done against this average 200-foot head. The daily records of the amount of water pumped are not reckoned from the number of revolutions made by the engines or pumps, but are taken directly from meters installed in the mains, and consequently whatever small amount of slip may be present is provided for, and only the actual number of gallons pumped enter into computation. Probably one of the most remarkable day's runs was that made August 18, 1910, when 330,000 gallons of water were pumped against a discharge head of 210 feet, with attendant coal consumption of 700 pounds. This averages nearly a million gallons per ton of coal, and as the suction lift represented about a 25-inch vacuum, the day's work was accomplished at an exceedingly high efficiency.

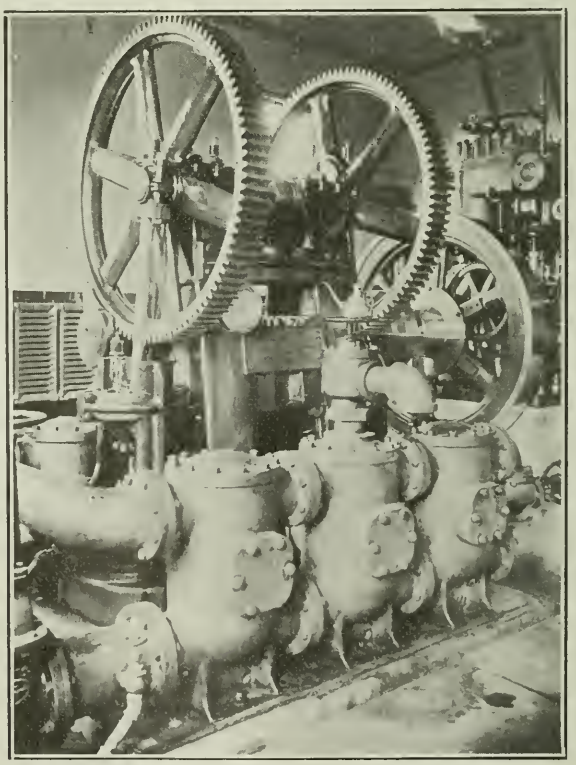
Mr. Raymond C. Allen, the supervising and consulting engineer of the water board, was confronted with rather an interesting problem in the design of this plant, but one which he successfully solved in a simple manner. The water used in the scrubbers of the producers for purifying the gas is rendered poisonous and unfit for consumption. The shores of the pond on which the station is situated are rather steep on all sides and form the watershed from which the supply is obtained. It was necessary, then, to construct a small receiving reservoir on the other side of the watershed, from which the water from the scrubbers could be piped. This was done and the poisonous water is now forced over to the other side of the shed by means of a small Goulds pump, located in a pit near the engine base. In consequence of this precaution the water from Gravel Pond is as pure and clear as though it sprung from an artesian well and is much softer than that formerly obtained from the old station.

A New Motor Drive for Fire Apparatus.

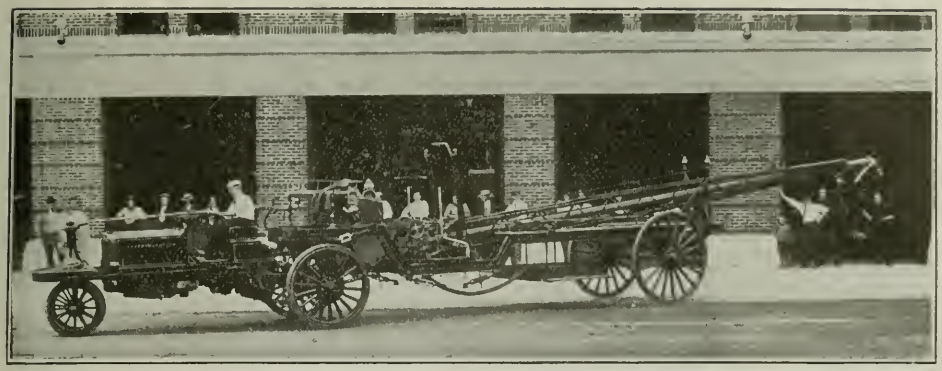
A novel vehicle has just made its appearance on the streets of Springfield, Mass., which creates as much excitement as did the first horseless carriage some years ago. It



GRAVEL POND PUMPING STATION, MANCHESTER, MASS
1,000,000 Gallon Gould Pump Driven by Nash Gas Engine.



HOME PUMPING STATION, MANCHESTER, MASS.
750,000 Gallon Gould Pump.



THE MARTIN TRACTOR ATTACHED TO SPRINGFIELD, MASS., WATER TOWER.

consists of a piece of fire-fighting apparatus, known as a water tower, with a motor attachment in front, to take the place of horses. This is the latest product of the Knox automobile factory, and was built for the fire department of Springfield. It was invented and designed by Charles H. Martin, a well-known authority on matters pertaining to motor haulage.

The device consists of a steel frame, carrying a motor and transmission machinery, which is placed in front of a fire engine or other apparatus designed to be horse-drawn. It rests on the front axle of the vehicle to which it is attached. In front it is supported by a single wheel or two wheels placed close together. This construction gives it a more or less freaky appearance, but is said to be necessary in order to make short turns and to handle the vehicle in narrow streets.

The frame is supported on easy springs in both front and rear, which prevents the engine and drawing mechanism from being shaken to pieces on rough roads. The engine is geared by means of chains and sprockets to the front wheels of the vehicle, the whole making a complete motor-drawn piece of fire-fighting apparatus.

This device is as well adapted to all kinds of heavy trucking as it is to fire apparatus.

Mr. Martin is very enthusiastic about his invention. In describing it he said:

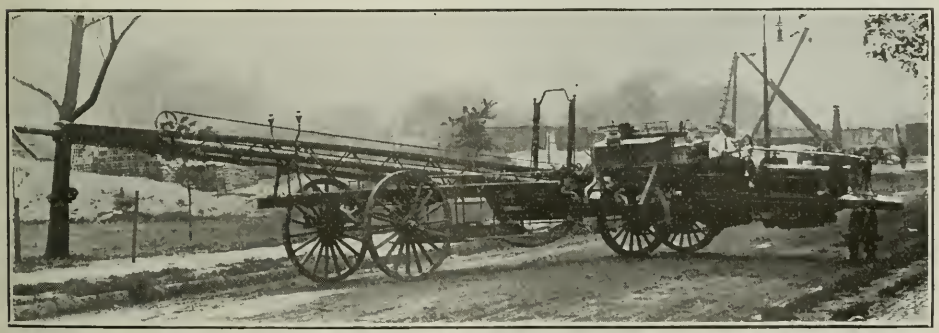
My tractor eliminates half the complications of ordinary motor truck construction, it cuts the expense of building and of upkeep in half, and at the same time it increases efficiency.

It proved out in practice all it promised in theory, and that is all we could ask. We are more than pleased with the tests. We carried 18,000 pounds up an 8 per cent. grade on a muddy road surface with only 21 per cent. of the total load on the driving wheels, which were fitted with special traction tread steel tires. There was not the slightest slippage, nor could we make the wheels skid on the wet asphalt, proving conclusively that it is possible to obtain traction with a steel tire.

We then drove over curbs, through plowed fields, through sand banks, maneuvered through the woods and did stunts which would be impossible with ordinary motor truck construction. We described a complete half-circle with the frame and the vehicle moved forward one foot, showing that we could drive through the differential and handle the vehicle just as we would with a pair of horses.

Every city in the country has several ladders, steam fire engines and other horse-drawn apparatus of proven worth which does not lend itself to ordinary automobile construction, that by the use of Martin's device can become motor driven and thus increase its usefulness 100 per cent.

The Knox Company will manufacture the appliance under Martin's patents, and the marketing will be done by a sales company, which Mr. Martin is at present organizing.



THE MARTIN TRACTOR TURNING AROUND IN A THIRTY FOOT STREET WITH ROOM TO SPARE.

Laying Brick with the Mathews Gravity Carrier.

There seems to be no field of modern endeavor where the inventive genius has not found an opening for the introduction of labor-saving appliances. Thousands of ideas have had their ultimate fruition in mere junk, while countless aspirants for fame and riches have wasted their lives in pursuit of a mechanical chimera. Many inventors have centered their attention upon producing freaks of mechanical construction, the work performed and the saving effected by their use not being compensatory for the investment and cost of operation and maintenance.

The greatest labor-saving machines are the embodiment of simple ideas worked out by simple mechanical methods. These are readily adopted by the public and yield large returns to the inventor or manufacturer.

LAYING PAVING BRICK. SHOWING METHOD OF USING MATHEWS GRAVITY CARRIER.

In the accompanying picture we illustrate one of the simple devices which accomplishes a simple task in a simple manner. It employes a force of nature, gravity, in operation. It consists of ball-bearing rollers set in a steel frame, the frame being coupled together and established on a slight grade. Such commodities as paving brick, tiling or other materials with comparatively smooth surface, will travel by their own weight any desired distance quickly and without injury.

The picture shows one of these gravity carriers set for conveying paving brick from the sidewalk pile to the bricklayers on the street. For such work the device has been found very efficient. It saves wheeling brick, the chipping from dumping, and the disturbance of the brick that have been laid by the wheeling and dumping. It also delivers the brick just where they are wanted by the layer so that they save him handling. As a time and labor saver it is a success, and thus pays for itself quickly.

The gravity carrier is very satisfactory for unloading brick from cars to wagon, especially if the wagon cannot be brought close to the car, for the frames can be set readily so that the brick in the car can be deposited at one end and taken off at the other in any convenient place for easy piling in the wagon.

The Mathews Gravity Carrier Co., St. Paul, Minn., who manufacture this device, have had very satisfactory success in placing them with contractors throughout the country. The following is a partial list of recent sales:

Hadway Bros., Olmstead Falls, Ohio; John Seels, Canton, Ohio; W. M. Pattison Supply Company, Cleveland, Ohio; Gould & Maybach, Painesville, Ohio; E. McShaffery & Son, Akron, Ohio; M. Ford, Cedar Rapids, Iowa; Patrick Reddington & Sons, Baltimore, Md.; Windsor Brothers, Akron, Ohio; J. T. Lynch, Circleville, Ohio; E. E. Morgan, Ravenna, Ohio; M. J. Beach, Baltimore, Md.; William Elder, Baltimore, Md.; H. P. Kniseley, Canton, Ohio; E. D. Bowen, Twinsburg, Ohio; A. J. Himes, Engineer N. Y. C. & St. L. R. R., Cleveland, Ohio; W. H. Vogt & Son, Beach City, Ohio; Messrs. Paul & Henry, Barberton, Ohio.

1. POURING G-K COMPOUND IN WATER COVERED JOINT.

A Flexible Water-Tight Sewer Joint.

To the Editor of MUICIPAL ENGINEERING:

Sir—Your department, "Workers in the Field," contains many articles of great interest to engineers and contractors and the extreme importance of water-tight sewers causes me to send you photos of joints made under conditions as shown and sworn to by Mr. G. W. Robbins, industrial photographer.

Photos Nos. 1 and 2 show photos of 12-inch tile jointed in water with the pipe nearly submerged, eliminating the necessity of pumping, the same joint taken up and showing the bottom of the joint and a section cut from same, showing the complete filling of the annular space with the G-K compound.

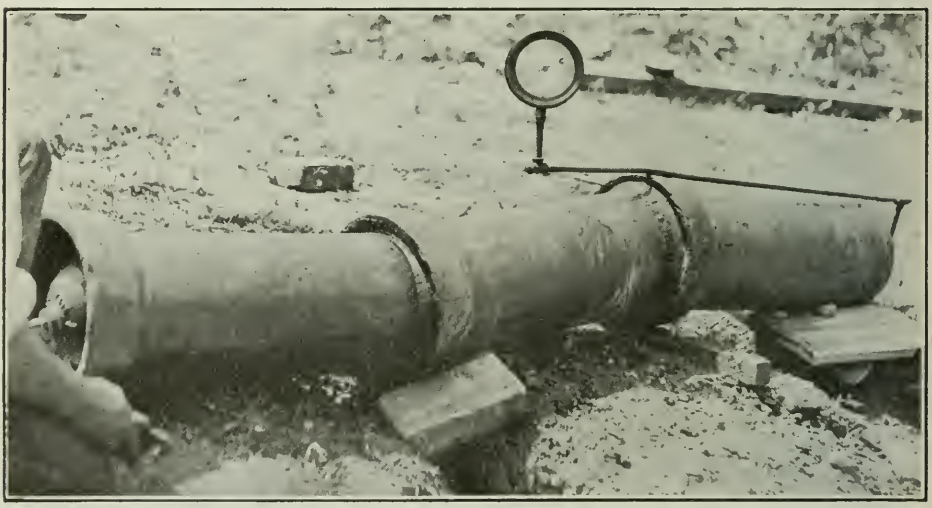
No. 3 represents three lengths of tile jointed in perfect alignment and after the compound had set and was cold was slowly deflected and tested to 15 pounds pressure without joint showing leak. An inspection of joint with reading glass will show the stretching of the compound, proving its flexibilty. Ths test is of great moment to the engineer and contractor, as it obviates the chance of broken tile from heavy backfill on soft subgrade.

No. 4 shows 2 lengths of 8-inch tile jointed with G-K and suspended from beam, bell end down, a hole drilled through the lower pipe, and, on a bar passed through, the aggregate weight of men on bar was 750 pounds.

No. 5 shows cast iron pipe jointed with G-K and under pressure to 115 pounds. The

3. G-K COMPOUND JOINT UNDER TENSION.

2. CUT SEWER PIPE JOINT SHOWING FILLING WITH G-K COMPOUND.



4. SHOWING FLEXIBILITY OF WATER TIGHT JOINT MADE WITH G-K COMPOUND.

5. CAST IRON PIPE JOINT OF G-K COMPOUND UNDER 115 POUNDS PRESSURE.

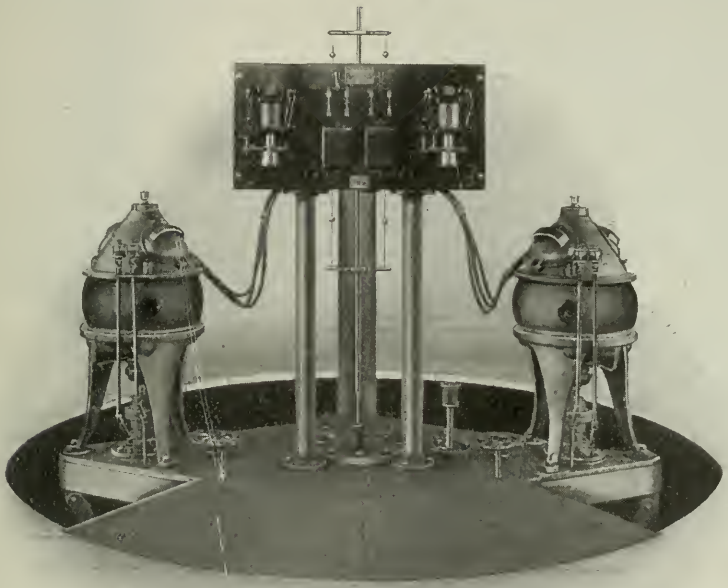
pressure was continued to 160 pounds, when the pipe burst. This test from an economic standpoint should be of great value to contractors laying iron water mains, as it is tight and bonded to the pipe for the complete depth, while a lead joint is only as tight as the perfect calking will make it, and then only for a depth of ¼ inch, rarely deeper, and the cost of the compound is only 1/7 that of lead, and where there is no calking or extra excavation the item of saving is very large. Its standing pressure test and the report of a prominent Canadian chemist that it is not acted upon by water or earth makes it an article that many engineers should give consideration. D.

Trade Publications.

The International Harvester Company has issued a booklet entitled "The Truth About the International Harvester Company," which purports to be an answer in full to the Townsend report, and was filed with the Stanley committee at Washington on August 12.

The Robeson Process Co., Au Sable Forks, N. Y., is publishing a series of "Roads Handbooks," one on "Dirt Roads" being a reprint of an article in MUNICIPAL ENGINEERING.

The Lehigh Portland Cement Co., Chicago, Ill., has published a new edition of DeWitt V. Moore's "Forty-One Concrete Reasons,"



FORM A, SUCTION TYPE, YEOMANS DUPLEX ELECTRIC SEWAGE EJECTOR INSTALLATION.

Electric Sewage Ejectors.

Yeomans Brothers, 1240 Monadnock block, Chicago, Ill., are manufacturers of electric pumps of various sorts, centrifugal, rotary and triplex, house pumps, bilge pumps and ejectors, as well as rotary air compressors. The centrifugal ejector is applied with success to sewage outlets or purification plants where pumping is necessary. As shown by the cut, it takes but small space and can be arranged with automatic control so that it can act intermittently, or either pump can operate alone if the other is out of order. A full description of the ejector will be found in MUNICIPAL ENGINEERING, Vol. xl, page 300, or can be obtained from catalog D, which will be sent upon request to the manufacturers.

which is fully illustrated and gives by pictures the evidence on which many of the reasons stated, are based. The first edition was 15,000 copies, and the demand for this second edition will be still greater. A copy can be had for the asking.

What quality in Lehigh Portland Cement means is shown by the statement in a small circular, that the company received an average of 23 cents a barrel premium on cement furnished on a government contract for which the specifications provided that a bonus of 5 cents a barrel would be paid for every ten pounds increase in tensile strength the cement showed over the specified 300 pounds per square inch in 28 days, briquettes being of 1 to 3 mortar.

Browning locomotive cranes is the sub-

ject of a new catalog of the Browning Engineering Co., Cleveland, O. The illustrations of the many uses to which the cranes are put are extremely interesting.

The Rockwell Furnace Co., New York, describe the Lalor automatic stop-valve for accident in bulletin 29.

Byerley & Sons, Cleveland, Ohio, manufacturers of Byerlyte asphalt, have just issued four very attractive and interesting booklets on asphalt and its various uses. These booklets are for free distribution and will be of great value to engineers, contractors and others interested in the use of asphalt in its many branches. Copies will be forwarded to those interested.

The American Steel Post Co., Los Angeles, Cal., have issued catalog 10 showing their lines of steel posts and poles, which have been designed along engineering lines and should be correspondingly satisfactory in service and economy.

Solon G. Howe, Detroit, Mich., has a sanitary catch basin which is readily cleaned and flushed, and concerning which he will send full information.

"Hydraulic Pumps, Catalog No. 81," is the title of a new 120 page 6x9 catalog, descriptive of many standard and several new types of hydraulic pumps. This catalog, issued and sent free by The Watson-Stillman Co., 50 Church street, New York, contains valuable information for hydraulic engineers and users of hydraulic machinery.

The August bulletin of the Lehigh Portland Cement Co., is devoted to a description of their new cement manufacturing plant at Mason City, Iowa, which is now ready for operation.

The latest Farm Cement News of the Universal Portland Cement Co., is largely devoted to concrete tanks, silos and cisterns.

Peoria Ornamental Lights.

The city of Peoria developed last spring an interest in ornamental lights and the Merchants' Association, after some investigation, decided upon the form of standard shown in the accompanying cut. At the request of the president of that organization the Peoria Gas and Electric Company purchased 65 of these "Corinthian" standards in May, and they have been set on Adams street, as noted elsewhere in this number of MUNICIPAL ENGINEERING.

The "Corinthian" standard, when equipped, requires a 100-watt tungsten lamp above and four 80-watt lamps in the lower level. This makes a current consumption of 2,500 kilowatts per year for the center lamp and about 5,000 kilowatts per year for the side lights. The city pays for the current and maintenance of the posts. The merchants paid the first cost of the posts, which were deeded to the city.

Among the numerous cities using these handsome standards are Wichita and Topeka, Kas.; Ottumwa and Oskaloosa, Iowa; Monmouth, Elgin, Pekin, Peoria, Ill.; Kingston, N. Y.; Knoxville, Tenn. They are made by the Flour City Ornamental Iron Works, Minneapolis, Minn.

THE CORINTHIAN STANDARD.

Trade Notes.

San Francisco, Cal.—The Steel City Electric Co., Pittsburg, Pa., have appointed the Aylesworth Agencies Co., San Francisco, Cal., their Pacific coast sales representatives.

Milwaukee, Wis.—The department of public works has authorized the purchase of equipment to utilize waste steam at the garbage incinerating plant for operating motors in the municipal water works system; $80,000. Harry E. Briggs, commissioner of public works.

San Francisco, Cal.—The Board of Public Works has been authorized to construct the Geary Street Municipal Railroad, $270,000. W. R. Hagerty, clerk.

Reading, Pa.—Contract has been awarded Allentown Portland Cement Co., for the Penn street bridge.

Laurel, Ind.—George McBarler, trustee Perry township, wants one road grading machine.

Council Bluffs, Iowa—Bids will received September 7 for furnishing 5,000 barrels of Portland cement in carload lots f. o. b. Council Bluffs. S. L. Etnyre, superintendent water works.

IMPROVEMENT AND CONTRACTING NEWS

RMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Little Rock, Ark.—Sept. 12, 2 p. m. Constructing a pike road. J. Evan Jones, auditStamford, Conn.—Sept. 5, 8 p. m. Constructing 6,500 square yards of brick pavement in Elm street. Harold A. Parsons, city engineer.

Jacksonville, Fla.—Sept. 5. Reconstructing 23,268 square yards of pavement in Bay street. Philip Prioleau, city engineer.

Lewiston, Idaho—Sept. 6. Constructing 19,000 square yards of hard surface pavement. C. F. Leland, city clerk.

Bloomfield, Ind.—Sept. 5, 10 a. m. Constructing macadam roads in Richland and Jackson townships. Caswell H. Jennings, auditor Greene county.

Bluffton, Ind.—Sept. 5, 10 a. m. Constructing stone roads in Lancaster, Jefferson and Chester townships. O. D. Garrett, auditor Wells county.

Brazil, Ind.—Sept. 6, 11:30 a. m. Constructing a gravel road in Brazil township. E. A. Staggs, auditor Clay county.

Corydon, Ind.—Sept. 5, 2 p. m. Constructing gravel roads in Webster and Boone townships. Wm. Taylor, auditor Harrison county.

Decatur, Ind.—September 4, 10 a. m. Constructng macadamized road in Monroe township. H. S. Michaud, auditor Adams county.

English, Ind.—Sept. 5, 2 p. m. Constructing a pike road. J. Evan Jones, auditor Crawford county.

Franklin, Ind.—Sept. 9, 2 p. m. Constructing ten gravel roads. Chas. F. Cromwell, auditor Clinton county.

Greenfield, Ind.—Sept. 15, 2 p. m. Constructing road on line between Hancock and Henry counties. C. H. Troy, auditor Hancock county.

Greensburg, Ind.—Sept. 4, 1 p. m. Constructing macadam road in Clinton township. Frank E. Ryan, auditor Decatur county.

Huntington, Ind.—Sept. 4, 10 a. m. Constructing highway in Dallas township. John W. Weaver, auditor Huntington county.

Indianapolis, Ind.—Sept. 6, 10 a. m. Improving Emerson avenue. C. A. Schrader, president board of public works.

Kentland, Ind.—Sept. 4, 1 p. m. Constructing macadam road in Jefferson township. E. R. Bringham, auditor Newton county.

Knox, Ind.—Sept. 5, 12 m. Constructing gravel roads in Oregon, Center, Wayne, North Bend and Washington townships. Lee M. Ransbottom, auditor Starke county.

Laporte, Ind.—Sept. 7, 10 a. m. Constructing macadamized road in Hanna township. F. A. Hausheer, auditor Laporte county.

Lebanon, Ind.—Sept. 11, 7:30 p. m. Constructing cement walk and curb in C street. Edmund Connor, city clerk.

Lebanon, Ind.—Sept. 4, 2 p. m. Constructing gravel road in Clinton township. B. F. Herdrich, auditor Boone county.

Logansport, Ind.—Sept. 5, 10 a. m. Constructing two macadam roads in Harrison township. J. E. Wallace, auditor Cass county.

Madison, Ind.—Sept. 5, 1 p. m. Constructing gravel road in Republican and Graham townships. Andrew M. Taff, auditor Jefferson county.

Marion, Ind.—Sept. 5. Constructing eight roads. J. A. Ridgway, secretary park board.

Monticello, Ind.—Sept. 6, 12 m. Constructing stone and gravel road in West Point, Prairie and Round Grove townships; also roads in Big Creek and Cass townships. A. G. Fisher, auditor White county.

Newport, Ind.—Sept. 7, 10 a. m. Constructing two gravel roads in Helt township. H. T. Payne, auditor Vermillion county.

Rushville, Ind.—Sept. 4, 2 p. m. Constructing macadam roads in Posey, Rushville, Noble and Jackson townships. Jesse M. Stone, auditor Rush county.

Salem, Ind.—Sept. 4, 1:30 p. m. Constructing road in Washington township. F. S. Munkelt, auditor Washington county.

Valparaiso, Ind.—Sept. 4, 10 a. m. Constructing two gravel roads. C. A. Blachly, auditor Porter county.

Vernon, Ind.—Sept. 4, 11 a. m. Constructing pike road in Spencer and Geneva township. M. V. Brogan, auditor Jennings county.

Vincennes, Ind.—Sept. 5. Constructing six gravel roads. John T. Scott, auditor Knox county.

Wabash, Ind.—Sept. 7, 10 a. m. Constructing highway in Chester township; also gravel road on line between Wabash and Kosciusko counties. J. P. Noftzger, auditor Wabash county.

Washington, Ind.—Sept. 5, 10 a. m. Constructing gravel roads in Elmore township. Thomas Nugent, auditor Daviess county.

Winamac, Ind.—Sept. 55, 12 m. Constructing three roads. W. E. Munchenberg, auditor Pulaski county.

Powson, Md.—Sept. 7, 12 m. Improving a section of Green Spring avenue, and grading a hill on Dogwood Road. Certified check, $100. Highways commission; Henry G. Shirley, county roads engineer.

Aberdeen, Miss.—Sept. 5, 2 p. m. Constructing various road improvement. W. H. Carlyle, secretary road commissioners, district No. 4.

Camden, N. J.—Sept. 7, 10:30 a. m. Constructing Gibbsboro and Berlin gravel road. J. J. Albertson, county engineer.

Huntington, N. Y.—Sept. 8, 11 a. m. Improving Main street. Certified check $500. Alonzo P. Whitson, town superintendent of highways.

Ashland, O.—Sept. 8, 1 p. m. Grading and macadamizing 1.6 miles of road under the state highway law, estimated at $9,547.12; also 1.04 miles, estimated at $6,320.54. Certified check, $300 with each bid. County commissioners. James R. Marker, state highway commissioner.

Columbus, O.—Sept. 15. Grading and macadamizing Jones road (1 mile); and constructing sidewalks on Broad street bridge. Commissioners of Franklin county.

Crooksville, O.—Sept. 9, 12 m. Grading, curbing, paving with brick, etc., in North Buckeye street. Certified check. Fred Cooke, village clerk.

Logan, O.—Sept. 4, 10 a. m. Grading and graveling 1.63 miles of road under the

state highway law. Estimate, $5,312. Certified check, $300. County commissioners; James R. Marker, state highway commissioner.

Maumee, O.—Sept. 2, 3 p. m. Constructing concrete tunnel on the premises of the Lucas county Children's Home. E. J. Brown, secretary. Bacon & Huber, Toledo, O., architects.

Millersburg, O.—Sept. 6, 1 p. m. Grading and macadamizing 1.4 miles of road under the state highway law. Estimate, $9,961.63. Certified check, $300. James R. Marker, Columbus, O., state highway commissioner.

New Philadelphia, O.—Sept. 11, 1 p. m. Grading Oliver hill. Certified check, $50. W. C. Schott, county auditor.

Port Clinton, O.—Sept. 18, 12 m. Paving Fulton street. Certified check, $200. J. A. Singler, village clerk.

Sandusky, O.—Sept. 18. 1:30. Improving Darrow road in Berlin township. John Deitz, auditor Erie county.

Springfield, O.—Sept. 2, 10 a. m. Grading and macadamizing 2.2 miles of road under the state highway law. Estimate $15,255.-04. Certified check, $300; county commissioners. James R. Marker, Columbus, O., state highway commissioner.

Woodfield, O.—Sept. 2, 9 a. m. Grading and paving with brick 1.08 miles of road in Center township. Estimate $18,891.40. Certified check, $300. County commissioners. James R. Marker, state highway commissioner.

Muskogee, Okla.—Sept. 5, 10 a. m. Grading and paving certain alleys, street improvement district No. 133. Certified check, $500. Chas. Wheeler, Jr., city clerk.

Duquesne, Pa.—Sept. 2, 12 m. Grading, curbing and paving Oak street. L. W. Francis, chairman street committee.

East Brady, Pa.—Sept. 5, 8 p. m. Laying 70-feet of five-foot concrete walk. T. M. James, borough secretary.

Jeannette, Pa.—Sept. 4, 8 p. m. Constructing a retaining wall at Gaskill avenue and Harrison road. Certified check, $25. Borough council.

North Braddock, Pa.—Sept. 5, 3 p. m. Improving Coatmont and Anderson streets, and Earl and Ajax alleys. C. A. Stewart, borough engineer.

Pittsburg, Pa.—Sept 12, 10 a. m. Improving Emsworth and Haysville road, Steubenville pike, and Buena Vista and Greenock road in Allegheny county. Certified check with each bid. R. J. Cunningham, county controller.

Pittsburg, Pa.—Paving with brick in Washington avenue, Borough of Dormont. Certified check, $500. R. J. Cunningham, county controller.

Johnson City, Tenn.—Sept. 7, 7 p.m. Paving, constructing sewers, etc. P. F. McDonald, city commissioner.

Wheeling, W. Va.—Sept. 5, 9 a. m. Paving Top Mill road. Board of control.

West Allis, Wis.—Sept. 2. Macadamizing National avenue. Frank C. Douville, acting chairman board of public works.

CONTRACTS AWARDED.

Covina, Cal.—Improving streets, to Benjamin F. Ford, Covina, $28,332.

Long Beach, Cal.—Paving Sixteenth street, to White & Gaskill, Long Beach, $47,867.79; constructing sidewalks and curbs to McComb Bros., Los Angeles, $25,000.

Los Angeles, Cal.—Street improvement contracts: Barber Asphalt Co., $75,000; Fairchild-Gilmore-Wilton Co., $19,139; Withers & Crites, $8,873; George H. Oswald, $93,455; Los Angeles Investment Co., $55,-000; F. H. Potts, $10,000; L. H. McGowan; O. O. Farmer, $40,787.92; J. O. Stanford, $14,342.99.

San Francisco, Cal.—Constructing asphalt pavement in twenty-fifth street, to Flinn & Treacy, San Francisco; and in Greenwich street, to W. C. Raisch.

San Jose, Cal.—Improving Capitol avenue and Darryessa Road, to F. Wehner, $9,100.

Santa Barbara, Cal.—Paving four streets, to the Santa Barbara Paving Company.

Hartford, Conn.—Contracts for state road work: 1,707 lineal feet of macadam-telford, to the B. D. Pierce Jr., Co., Bridgeport; 1,840 lineal feet of telford macadam in Stamford to L. F. Merritt, Stamford; 3,449 lineal feet of macadam-telford in Windham, to A. Vito & Co., Thompson; 6.007 lineal feet of macadam-telford in Windsor, to the Pierson Engineering & Construction Co., Bristol; 7,606 lineal feet of macadam-telford in Granby, to A. Vito & Co.; 6,215 lineal feet of graded road in Cornwall, to the B. N. Beard Co., Shelton; 1,100 lineal feet of grading in Beacon Falls, to John De Michiel & Bro., Torrington; 8,515 lineal feet of gravel-telford to the B. N. Beard Co.

Naugatuck, Conn.—Constructing 3,100 square yards of brick pavement, to Field, Barker & Underwood, Philadelphia.

Waterbury, Conn.—Paving Meadow and Grand streets, to Field, Barker & Underwood, Inc., Philadelphia, $21,016..

Jacksonville, Fla.—Paving Panama Park Road, to the Engineering and Paving Co., Jacksonville, Fla.

Jacksonville, Fla.—Paving Sixty-fourth street, 4,260 lineal feet, to George R. Foster, Jacksonvlle.

Key West, Fla.—Laying 67,000 yards of asphalt paving, to the Southern Asphalt Co., Birmingham, Ala., $150,000.

Rome, Ga.—Paving various streets with brick, wood blocks, and macadam, to Jamison & Hallowell, Montgomery, Ala., $13,304; Creosoted Wood Block and Paving Co., Gulfport, Miss., $5,317; Southern Asphalt and Paving Co., Birmingham, $29,769.40.

Chicago, Ill.—Paving Randolph and Clark streets with creosoted wood blocks, to William Bissack, $21,510.

Peoria, Ill.—Paving Sanford street ($14,-815), South Adams street ($14,815), and Lydia avenue ($11,285), to A. D. Thompson, Peoria.

Virginia, Ill.—Paving court house square and North Main street, to Richard Egan, Springfield, Ill., $27,806.

Winnetka, Ill.—Building four miles of asphalt concrete pavement, etc., to the Western Improvement Co., Racine, Wis.

Ames, Iowa—Paving five blocks of Grand avenue with creosoted blocks, to Wm. Horrabin, Iowa City, Ia.

Des Moines, Iowa—Paving Thirty-sixth street, sheet asphalt, to Mayer Bros. Paving Co., Des Moines.

Oelwein, Iowa—Constructing 42,000 square yards of brick block paving, to Dearborn & Jacsokn, Cedar Rapids, and William Horrabin, Iowa City, $80,000.

Red Oak, Ia.—Constructing twelve blocks Purington brick pavement, to Hamilton & Schwartz, Shenandoah, Ia.; curbing and guttering, to Horton Bros., Red Oak; nine blocks brick paving, to McMaken Bros., Plattsmouth, Neb.

Shenandoah, Ia.—Constructing 24,000 square yards of asphaltic concrete pavement, to M. Ford, Cedar Rapids, Ia.

Waterloo, Ia.—Repaving with asphalt in Fourth, Bridge and Commercial streets, to the Bryant-McLaughlin Asphalt Paving Co.

Bedford, Ind.—Constructing cement walk and brick pavement, to Ewing Shields, Seymour, Ind., $20,000.

Bloomington, Ind.—Constructing two miles of macadam road with asphalt binder, to George T. Miller, Lebanon, Ind., $24,994.

Fowler, Ind.—Constructing Erskine road, $3,300, and Gerlach road, $4,500, to Girmut & Co., Muncie, Ind.

Jacksonville, Ind.—Paving Meridian street to Ewing Shields, Seymour, Ind., $18,275.57.

Logansport, Ind.—Constructing roads as follows: Gray road, to H. A. Barnes & Son, Logansport, $8,978, and Cotner road, $8,845; Riley road, to E. E. Barnard, Delphi, Ind., $4,362; Stevens road, to Martin McHale, Logansport, $16,200, and Ross road, $16,587; Farlow road, to Barnes & Grauel, Logansport, $13,801; Ira Cotner road, to Browning & Shafer, Royal Center, Ind., $12,500; bridge and concrete work, to Samuel Cotner, Logansport.

Martinsville, Ind.—Constructing macadam road, to J. C. Greer, Martinsville, $8,519.

Newport, Ind.—Constructing Rock Spring gravel road, to George R. Chatman, Clinton, Ind., $7,740.

Rockville, Ind.—Building Bellmore road, four miles, to J. H. Van Fassan, Rockville.

Rushville, Ind.—Constructing two roads, to Wilk & Co., Rushville, $10,495.

Salem, Ind.—Constructing gravel road, to Christian & Engler, Salem, $17,095.

Terre Haute, Ind.—Constructing three miles of rock and gravel road, to Dorsey & Co., Terre Haute, $9,450.

Wabash, Ind.—Improving Manchester avenue, to the Western Construction Company, Lafayette, Ind., $44,000.

Atchison, Kas.—Paving Carney street, to the Atchison Paving Brick Co., $22,994; paving Waggener boulevard, to Arnold & Graves, $6,881.

Leavenworth, Kas.—Constructing asphalt pavement in Shawnee street, $19,234 square yards, $23,850, to Jo. Ramsey & Co., Topeka, Kas.

Shreveport, La.—Constructing street pavement, to the General Paving Co., Hot Springs, Ark., $175,000; Chatwin Bros. Riprap Contracting Co., Shreveport, $11,340; Southern Bilulithic Co., Nashville,, Tenn., $40,000.

Boston, Mass.—Constructing wood block pavement, etc., in East Fourth, Milk and Standish streets, $11,000; and in Washington street, $16,409, to James Doherty, Boston; Sachem street, to Daniel E. Lynch, $2,860; state highway in Swansea, to P. F. Giovannini, $4,226; along Stony brook, to Jones & Meehan, $29,212; in Champney street, to the J. C. Coleman & Sons Co., $5,332.

Detroit, Mich.—Paving in Lafayette boulevard, to Ferdinand Porath, Detroit, $6,081.

Ludington, Mich.—Constructing gravel road, to Clarence Sheppard, Ludington, $18,000.

Pontiac, Mich.—Paving South Saginaw street, etc., to Cleveland Trinidad Paving Co., $37,000.

St. Joseph, Mich.—Constructing brick pavement, to Chas. Kingsley and Henry Shultz, St. Joseph, $15,287.

Bemidji, Minn.—Constructing 21,000 square yards concrete paving, to the Northern Construction and Engineering Company, Grand Forks, N. D.

Duluth, Minn.—Improving West End streets, to Hugo Steele, $41,141; West Fifth street, to C. R. McLean, $3,590.60; Hartley road, to J. A. Johnson, $19,233, and E. A. Dahl, $4,500.68.

St. Paul, Minn.—Various street improvement works, to Fielding & Shepley, and Keough Bros., St. Paul, about $60,000.

Joplin, Mo.—Paving Main street, to Burke Bros., St. Louis.

Missoula, Mont.—Improving Connell avenue, to the Miracle-Tripp Company, Missoula, $13,643, and Hilda avenue, $10,493.

Concord, N. H.—Constructing state highways, five mile at Hooksett and Merrimack, to E. J. Rourke, Abington, N. H., $33,734; and one and one-third miles at Bedford, to C. W. Tryon, Meriden, Conn., $6,311.

Audubon, N. J.—Constructing cement pavement, to Edward Wiglesworth, Collingswood, N. J., $10,000.

Camden, N. J.—Resurfacing Westfield avenue, to the Kelly, McFeely Construction Co., $36,158.88.

Englewood, N. J.—Constructing asphalt block pavement on D street, to the Hastings Paving Company, New York, $9,574.

Hammonton, N. J.—Constructing sidewalks, to W. Kirkspear, $11,000.

Trenton, N. J.—Constructing Trenton, Lawrenceville and Brunswick pikes, to Willard S. Conover, $35,536.

Westfield, N. J.—Improving North avenue, macadam, etc., to Liddle & Pfeiffer, Perth Amboy, N. J., $10,420.

Elmira, N. Y.—Paving East Union Place with Corning block and Medina curb, to Connors & Gallavan, Elmira, $7,425.

Lancaster, N. Y.—Paving Central avenue, to the Niagara Construction Co., Buffalo, $37,949.

Larchmont, N. Y.—Laying 25,000 feet of cement sidewalk, to Daily & Merritt, Port Chester, N. Y., $20,000.

New York, N. Y.—Constructing wood block pavement in Richmond terrace, Staten Island, to the United States Wood Preserving Co., $44,722.40.

Utica, N. Y.—Repaving Oneida street with bitulithic, to Warren Bros. Co., $11,820.

Akron, O.—Paving High street, to McAlonan Bros. and S. W. Parshall, $50,000 each; Second street to Mather McCourt, $20,000; Johnson street to Walter & Russell, $35,000; Tallmadge avenue, to E. McShaffrey & Sons, $40,000; Water street ($25,000), and South street ($7,5000), to Wildes & Davidson, all local contractors.

Canal Dover, O.—Paving Wooster road, to Springer & Rogers, New Philadelphia, O., $29,660.12.

Sardington, O.—Constructing Osborn road, to Shaw & Uncapher, Marion, $16,076.36; Clark and Purinton road to Frank Holt and Tarper Fleming, $18,615; and Mills road, to L. R. McMichael, Bucyrus, $13,064.38.

Columbus, O.—Paving Thurman avenue, to the Andrews Asphalt Paving Co., Hamilton, O., $24,000, and Wilson avenue, $16,000; Michigan avenue, to J. C. Beasley, Columbus, $21,000; Johnson street, to William M. Graham, $15,000, and Cleveland avenue, $15,000; Chittenden avenue, to George W. Patterson & Son, $10,000; Rich street, to Geigle, Garnes & Co., Columbus, $13,000.

Fayette, O.—Constructing 8,000 square yards street pavment, etc., to M. F. O'Sullivan, Fayette, $18,000.

Marion, O.—Constructing Tron pike, to Hofstetter & Dawson, $7,714; Cardington road, to M. W. Shaw & L. D. Uncapher, $17,000.

Marion, O.—Paving Olney and Blaine avenues, to Carpenter & Andrews, Grand Rapids, Mich., $19,712.

Martins Ferry, O.—Constructing Pultney township pike, to W. J. McClain, Bellaire, O., $18,000.

Mineral City, O.—Piking county roads, to Edward A. McCollam, G. A. Genfet, and Kimmel Steinbaugh.

Tiffin, O.—Constructing pavement, to W. & H. Jeckle, Holgate, O., $13,979; E. A. Freshwater & Sons, Cleveland, $13,766; John E. King, Franklin, O., $32,355; and Louis Schauder, Tiffin, $3,889.

Toledo, O.—Repairing Jerusalem stone road No. 4, Garrigan Bros., Toledo, $27,167.

Xenia, O.—Constructing roads under the state highway law, to the Wilson Engineering & Contracting Co., Xenia, $13,225; and to Korah E. Kunle, Dayton, $5,769.

Duncan, Okla.—Laying brick pavement in the business district, to Connelly Construction Co., ElReno, Okla., $55,000.

Oklahoma City, Okla.—Paving Olie street with asphalt, to Cleveland Terminal Paving Co., $28,278; Harvey avenue, to the Western Paving Co., $29,322.

Hood River, Ore.—Paving, curbing, etc., aggregating $32,252, to C. Johnson, The Dalles, Ore.

Independence, Ore.—Laying five blocks concrete paving, about $14,000, to Bidwell, Hayden & Co., Portland, Ore.

McMinnville, Ore.—Paving 62 blocks in the business district and part of the residence district with bitulithic, to Warren Construction Co., Portland, Ore., $120,000.

Portland, Ore.—Constructing asphalt pavement in Skidmore and other streets, to Warren Construction Co., $306,383; grading and laying curbs and sidewalks in East 34th street, to Miller & Bower, $20,031.

Harrisburg, Pa.—Constructing state highway between Ligonier and Stoyestown streets (23½ miles), to J. H. McQuaide, Pittsburgh; and between Bedford and Stoyestown (25 miles), to H. G. Hinkle, Altoona.

Mt. Carmel, Pa.—Constructing 26,000 sq. yd. brick pavement, to Fendale & Co., Mt. Carmel, $62,000.

Mt. Pleasant, Pa.—Constructing roads, to McGrady & Co., Braddock, $71,248; H. B. Cunningham & Son, Turtle Creek, $45,217; and P. J. Keck, Homestead, $73,762.

New Castle, Pa.—Repaving Long avenue, to Burns Bros., $7,209; Washington street, to W. H. Maguire, $15,401.50, and to New Castle Contracting Co., $3,107.60; North street, to W. H. Marquis, $8,523.97; storm sewers, to Burns Bros. and to Kimbrough & Elder.

Pittsburgh, Pa.—Raising streets in the flood district, north side, to John F. Casey, $29,380.88; repaving Liberty avenue, to Booth & Flinn, Pittsburgh, $23,982.30; paving Harwood street, to Ott Bros., Pittsburgh, $9,024.37.

Reading, Pa.—Macadamizing streets, to John Weidner, $10,075.08.

Washington Pa.—Furnishing brick for ten county roads, to United Fire Brick Co., Uniontown; Pennsylvania Clay Co., Pittsburgh; the Pittsburgh Buffalo Co., Pittsburgh; and James M. Porter, Pittsburgh; also constructing 22 miles of brick-paved highway, aggregating $348,259.95, to F. J. Erbeck of Homestead, Collins-Gordon Co. of Pittsburgh, Samuel Gamble of Carnegie, Hastings & Piper of Charleroi, Reed & Liggett of Washington, and William Pickett & Co. of Washington.

Chattanooga, Tenn.—Paving Whiteside and Main streets and Georgia avenue with sheet asphalt, to the West Constructing Co., Chattanooga, $75,138.

Nashville, Tenn.—Constructing 5,000 lineal feet of granitoid curbing and sidewalks, to M. J. Cunniff & Co.

St. Elmo, Tenn.—Paving Westside and Main streets and Georgia avenue, to West Construction Co., Chattanooga, $75,138.

Longview, Tex.—Constructing street pavement, to Roach & Monigon, Memphis, Tenn., $60,000.

Bellows Falls, Vt.—Grading and paving Bridge street, to Robinson & Baldasaro, Bellows Falls.

Norfolk, Va.—Paving, etc., on Graydon avenue, to Louis Lawson, Norfolk.

Bellingham, Wash.—Paving Dupont street with bitumass, to the Northwest Bitumass Co., $10,500.

Pasco, Wash.—Constructing concrete walks and curbs, to Midland Engineering Co., North Yakima, $44,000; and to Jahn Contracting Co., Seattle.

Seattle, Wash.—Paving, etc., in Yeseler way, to Allain & Ball, Seattle, $8,261.50.

Seattle, Wash.—Paving, etc., in 26th avenue, to W. F. Manney & Co., Seattle, $14,138; in University street, to Allain & Hull, Seattle, $6,524.

Seattle, Wash.—Constructing sidewalks on 32nd avenue, to Allain & Hull, Seattle, $4,382.25; sidewalks on Weller street, to Smith Contracting Co., Seattle, $4,458.40; and paving 21st avenue North, to Barber Asphalt Co., $122,835.85.

Seattle, Wash.—Constructing E. H. Patton road, to Zindorf & Elliott, $4,743; Gehr Erickson road, to P. J. McHugh, $39,600; permanent highway No. 3, to Beel-Scott Co., $44,970; permanent highway No. 1, to Barber Asphalt Paving Co., $26,560; Yesler Way, to Allain & Hull, $8,262.

Seattle, Wash.—Constructing sidewalks on 32nd avenue, to Allain & Hull, Seattle, $4,382.25; sidewalks on Weller street, to Smith Contracting Company, Seattle, $4,458.40; and paving 21st avenue North, to Barber Asphalt Company, $122,835.85.

Spokane, Wash.—Grading, paving, etc., on Northwest boulevard, to J. S. Hill, Spokane, $121,720.

Spokane, Wash.—Paving, etc., to Bitumass Paving Co., Spokane, $3,640; Western Asphalt Paving Company, Spokane, $27,585.29; Inland Empire Hassam Paving Company, Spokane, $15,993; Naylor & Norlin, Spokane, $6,449; Massie Bros. & Long, Spokane, $7,750.

Tacoma, Wash.—Paving South 25th street, to the Keasal Constructing Company, $88,200.

Tacoma, Wash.—Regrading and paving South 25th street, to the Keasal Construction Company, $88,200.

Vancouver, Wash.—Constructing 8 miles of state road No. 77, to W. F. Guernsey, Vancouver.

Vancouver, Wash.—August 7, 8 p. m. Improving Franklin, Daniel, Columbia, 23rd and 25th streets, to J. F. Geoghegan.

Vancouver, Wash.—Laying sidewalks, etc., to Rector & Daily, $95,000.

Wenatchee, Wash.—Paving, etc., to Columbia Engineering and Construction Company, $49,887.

Wheeling, W. Va.—Constructing 17th street bridge, to the Independent Bridge Company, Pittsburgh, $8,000.

Green Bay, Wis.—Paving Dousman and East Walnut streets with sandstone blocks and Congress street with concrete, to the McGrath Construction Company; paving Adams street with asphalt, to John Brogan.

Milwaukee, Wis.—Paving various streets, about 198,000 square yards, to R. F. Conway Company, Chicago, $254,704.

Milwaukee, Wis.—Constructing bituminous pavement on Vliet and 27th street, to Badger Construction Company, Milwaukee, Wis.

Rhinelander, Wis.—Improving streets, to McGrath Construction Company, Green Bay, $13,625.

Sheboygan, Wis.—Constructing brick pavement, to Franz Radolff, Plymouth.

Superior, Wis.—Constructing cement sidewalks on Hammond avenue, to Ed. Johnson, 63½ cents per foot.

Hastings, Ont.—Constructing 50,000 square feet of cement pavement, to the Martin Jex Company, Cobourg.

Burnaby, B. C.—The American consul reports that contracts have been awarded for construction of sewers and pavements. The names of successful bidders and other particulars may be obtained from the Bureau of Manufactures, Washington, D. C.

Vancouver, B. C.—Paving, etc., to George Ledingham, Vancouver, $73,000; Columbia Bitulithic Company, Vancouver, $46,948; T. R. Nickson & Co., Vancouver, various contracts aggregating about $84,000.

CONTEMPLATED WORK.

Marianna, Ark.—The county has issued $100,000 bonds for road improvements.

Pine Bluff, Ark.—The city council has organized a district to pave streets with creosoted wood blocks. Wm. J. Parks, engineer.

Los Angeles, Cal.—The board of public works has authorized the purchase of 11,000 barrels of crude oil for use on the roads.

Marysville, Cal.—The city council has ordered the paving of C street.

San Francisco, Cal.—The board of supervisors have ordered the construction and paving of sidewalks in Third and Precita avenues and other streets.

San Mateo, Cal.—The trustees have voted to improve the roads in San Mateo Park with oiled macadam, $100,000. City engineer.

Selma, Cal.—The pavement of the princi-

pal business streets is contemplated.

Colorado Springs, Colo.—The city council has ordered street paving.

Steamboat Springs, Colo.—The city has voted $34,000 bonds for paving.

De Funiack Springs, Fla.—The county has voted $70,000 bonds for road building.

Jacksonville, Fla.—The county commissioners have ordered pavement on the Duval station road and concrete bridges on the Pensacola road.

Council Bluffs, Iowa. — The council has authorized the improvement of Harrison street.

Marshalltown, Ia.—The city council has ordered the paving of Fourth, Jerome and Park streets.

Belvidere, Ill.—Bonds have been sold for paving, $24,000.

Peoria, Ill.—The city council has authorized the grading of Chestnut and Jackson streets and the construction of sidewalks on four streets.

Pontiac, Ill.—The city council has voted to pave West Henry street, $10,640.

Rantoul, Ill.—The city council has voted to pave Sangamon avenue, the principal business street.

South Bend, Ind.—The board of public works have ordered the paving of Race, Front, Third and Spring streets. Wm. S. Moore, city engineer.

Bellevue, Ky.—The city council has ordered the construction of paving, etc., in Grandview avenue. Geo. Trunnel, Jr., city clerk.

Pittsburg, Kan.—The city has voted $225,000 to buy water plant and $40,000 to improve and extend same. L. E. Curfman, city engineer.

Topeka, Kan.—The city commissioners have provided for paving 10 blocks in Chandler, Branner, Lake, Line and Lawrence streets.

Duluth, Minn.—The city council has authorized the improvement of Regent street. Board of park commissioners.

Hibbing, Minn.—The city council has ordered the construction of cement sidewalks on several streets.

Litchfield, Minn.—Cement sidewalks have been ordered in on several streets. John Rodange, village recorder.

Pipestone, Minn.—Cement sidewalks have been ordered in on several streets. S. W. Funk, city recorder.

Fulton, Mo.—The city has voted to form a special 8-mile road district.

Kirksville, Mo.—The city council has ordered the paving of East Harrison and North Elson streets and various alleys. J. C. Carothers, city clerk.

Albany, N. Y.—The Governor has signed appropriations for $1,000,000 to highway improvemtnts in Onondaga and Jefferson counties, $250,000 in Greene county and $450,000 in Oswego and Onondaga counties.

Albany, N. Y.—The state has appropriated $380,000 for the construction of a highway from Brewster northward.

Elmira, N. Y.—The common council has authorized paving in Desmond, Lockhart, Lehigh and Packer avenues.

Irvington, N. J.—The town council has authorized paving in Fortieth and Twentieth streets. M. Stockman, town clerk.

Penn Yann, N. Y.—The village has voted bonds for paving Main and East Main street with brick, $75,000.

Max, N. D.—Cement sidewalks have been ordered in on several streets. Theo. W. Kamps, village clerk.

Akron, O.—The city council has ordered grading, paving, etc., in Jefferson and Wooster avenues. D. W. Harter, clerk.

Athens, O.—The village council has authorized the paving in First, Lancaster and Walker streets and Miller alley. W. B. Golden, clerk.

Barnesville, O.—The city contemplates improving Mulberry, North Broadway, Church, St. George and Laws streets. F. W. Hilles, city clerk.

Bellaire, O.—The city council has ordered curbing and sidewalks on Twentieth street. G. W. Althar, clerk of council.

Cincinnati, O.—The city council has ordered the paving of Delaney street. Edwin Henderson, clerk.

Cleveland, O.—The city council has authorized the improvement of the boulevard between Woodland Hills and Garfield Park.

Cleveland, O.—The city council has voted to construct paving in McCurdy, 104th and West 35th streets, Otto and Gibson avenues, St. Alexis court and Parkwood drive.

Columbus, O.—The city council has passed resolutions for the paving of Allen and Thirteenth avenues, and for the construction of 5-foot cement sidewalks on four streets.

Dayton, O.—The city council has authorized grading and graveling of Wildwood and Epworth avenues and Haller street. Wayne E. Lee, clerk of council.

East Liverpool, O.—The city council has ordered the improvement of St. Clair avenue and St. George street.

East Liverpool, O.—The city council has authorized grading and paving in Travis alley, Minerva street, Apple alley and Green lane. C. V. Beatty, director of public service.

East Liverpool, O.—The city council has voted to grade St. Clair, West Eighth and St. George streets. R. L. E. Chambers, clerk.

London, O.—The city council has authorized the paving of First, Main and Fifth street, about 6,700 lineal feet.

Mansfield, O.—The city council has authorized grading and laying sidewalks in Buckley and Western avenues. Director of public service.

Marietta, O.—The city council has voted to pave Glendale street. V. B. Hovey, president.

Middletown, O.—The city council has authorized paving in Christel and Titus avenues. John Kunz, clerk.

Mineral City, O.—The county has ordered construction work on the Jefferson township and Newport pikes.

Niles, O.—The city council has authorized the paving of Vienna street.

Sebring, O.—The city council has authorized the paving of Ohio avenue. Harry Jenkins, clerk.

Steubenville, O.—The city council has ordered the improvement of Sinclair avenue and North Sixth street. Thomas W. Porter, mayor.

Toledo, O.—The city council has authorized grading and paving in Scottwood avenue. John M. Babcock, clerk.

Toledo, O.—The city council has authorized the paving of Woodland avenue and Buffalo and Mulberry and nine other streets. John M. Babcock, clerk of council.

Youngstown, O.—The city council has voted to pave Hayes avenue. M. F. Hyland, city clerk.

Youngstown, O.—The city council has ordered the grading of Plum street and paving in Hazel street and Grace avenue. M. F. Hyland, clerk.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Medford, Ore.—The city council has ordered 100,000 square yards of asphalt pavement in various streets.

Beaver Falls, Pa.—The council has authorized the improvement of Twenty-first street. Borough secretary.

Butler, Pa.—The city council has voted to do a considerable amount of paving during the remainder of the season.

Carnegie, Pa.—The town council has authorized the grading and paving of Highland avenue. H. R. Bigham, borough clerk.

Carnegie, Pa.—The council has voted to

pave Highland avenue and Homstead with brick. H. R. Bigham, borough clerk.

Charlevoi, Pa.—The town has voted $65,000 bonds for street improvements, a garbage plant and a municipal building.

Crafton, Pa.—The town council has ordered the construction of cement or stone sidewalks in Berry street. D. H. Haines, secretary.

Greenville, Pa.—The town council has ordered paving in North Race, South Race and North Mercer streets. J. M. Hittle, secretary.

Harrisburg, Pa.—The common council has ordered the pavement of Holly street. Chas. A. Miller, clerk.

Harrisburg, Pa.—The city council has authorized the grading of Kittatinny street and the paving of Basin alley and Holly street. Chas. A. Miller, clerk.

Harrisburg, Pa.—The common council has authorized the paving of Holly street with asphalt. Charles A. Miller, clerk.

Ingram, Pa.—The town council has authorized the paving of Hodgson avenue and Catherine street. D. H. Hainer, secretary.

Johnsonburg, Pa.—The town council has authorized the grading and paving of Grant street. S. W. Bayless, secretary.

McKees Rocks, Pa.—The borough council has authorized repaving with Ligonier blocks or stone blocks in Chartiers avenue. Jno. P. Pastre, secretary.

Monongahela, Pa.—The city has voted $65,000 bonds for street improvements.

Mt. Pleasant, Pa.—The town council has voted to grade, curb and pave North Shupe street. M. A. King, secretary of council.

New Castle, Pa.—The council has authorized several new paving contracts.

New Castle, Pa.—The city council has voted to grade Franklin avenue. H. M. Marquis, city clerk.

Parnassus, Pa.—The city has voted $22,000 bonds for street improvements.

Philadelphia, Pa.—Widening and raising the grade of Chestnut street as an approach to the Schuylkill river bridge, $40,000.

Pittsburgh, Pa.—The city council has authorized the paving of Fairplay street, $14,000. Joseph G. Armstrong, director department of public works.

Rankin, Pa.—The town council has authorized the paving of Fourth avenue. Carl Koellman, borough secretary.

Reading, Pa.—The city council has authorized the paving of Court, Fifth and Seward streets.

Scranton, Pa.—The city council has authorized the paving of Vine street, $2,068.50. Evan R. Morris, city clerk.

Scranton, Pa.—The council has voted to pave Oakford court. Evan R. Morris, city clerk.

Scranton, Pa.—Paving Kressler, Hitchcock and Vine court and Moir street and Prospect avenue; about $40,000.

Scranton, Pa.—The city council has authorized the repair of pavement in Providence road, $15,000. Evan R. Morris, city clerk.

Shamokin, Pa.—The town council has authorized the paving of Clay street with Pinegrove block. T. C. Roberts, secretary.

Sharon, Pa.—The town council has authorized paving in Shenango street, Mercer avenue and Park way.

Somerset, Pa.—The town council has voted to pave Rosina and East streets.

South Sharon, Pa.—The borough council has authorized the paving of Fruit street. John J. Noland, borough secretary.

Swissville, Pa.—The borough council has ordered the paving of Park avenue.

Swissville, Pa.—The town council has authorized the paving of McCague and Burton streets and Lloyd avenue. W. J. Cupples, secretary.

Wilmerding, Pa.—The council has authorized the paving of Locust alley. C. R. Shiring, borough secretary.

Chattanooga, Tenn.—The city commissioners have appropriated $25,000 for street improvements and sewers.

Jonesboro, Tenn.—The county court has voted $60,000 bonds to build the Bristol-to-Memphis highway in Washington county.

Bonham, Tex.—The city council has decided to pave Main street and the public square.

Dallas, Tex.—The city commissioners have ordered the paving of Jefferson street, two blocks. J. E. Lee, street commissioner.

Dallas, Tex.—The county has voted bonds for road improvement, $500,000.

Houston, Tex.—The city council has ordered all steam railroads shall pave their crossings at street intersections with brick.

Longview, Tex.—The city has voted $100,000 for road improvements.

Marquez, Tex.—The citizens have voted $30,000 bonds for road improvements.

Alexandria, Va.—The board of aldermen has ordered pavement, etc., in Cameron and Fairfax streets.

Dayton, Wash.—The city council has voted to pave Main and Commercial streets, about $80,000.

Follansbee, W. Va.—The city has voted $17,000 bonds for street paving.

Grafton, W. Va.—The city council has provided for the paving of West Main and Luzadder streets.

Milwaukee, Wis.—The construction of a boulevard along the Janesville plank road is contemplated.

Burnaby, B. C.—The American consular service reports that extensive road improvements are contemplated.

Coquitland, B. C.—The American consul general reports that the city contemplates purchasing two road rollers, one large and one small.

Point Grey, B. C.—The city has voted $349,908 bonds for roads.

Pernambuco, Brazil.—The American consul reports that the city has undertaken extensive street and park work.

SEWERS.

BIDS REQUESTED.

Prescott, Ark.—September 6. Constructing sewer improvements, district No. 1. 49,000 feet of pipe, 120 manholes, sewage treating bed, etc. M. W. Gresson, secretary commissioners; James W. Beebe, engineer.

Lemoore, Cal.—September 11, 8 p. m. Constructing sewer system. E. T. A. Bartlett, city clerk.

Wallingford, Conn.—September 5. Constructing sewer in Randolph street and Hall avenue. Court of burgesses.

Bushnell, Ill.—September 7, 7:30 p. m. Constructing 5 blocks of sewers.

Galveston, Ind.—September 6, 8 p. m. Constructing two sanitary district sewer systems. Eugene Masters, town clerk.

Peru, Ind.—September 2. Furnishing ½ mile of 6-inch to 12-inch drain tile. F. McElheny, auditor Miami county.

Belle Plaine, Ia.—September 11. Constructing 11½ miles of 8-inch to 18-inch sanitary sewers. S. H. Ferree, city clerk; Charles P. Chase, Clinton, Ia., engineer.

Paducah, Ky.—September 5, 10 a. m. Laying 1,146 feet of cast iron drain pipe. L. A. Washington, city engineer.

Lake Charles, La.—September 11. Constructing about 22 miles clay-pipe sewers, with pumping station and four reduction tanks. A. A. Wentz, secretary; W. G. Kirkpatrick, Jackson, Miss., engineer.

New Orleans, La.—September 11, 12 m. Constructing Napoleon avenue system of drainage canals and pipe lines; approximately 63,000 feet of reinforced concrete terra cotta pipe lines, etc. Certified check, $10,000. F. S. Shield, secretary sewerage and water board.

Baltimore, Md.—September 6, 11 a. m. Constructing lateral sewer in district 20B; high-level intercepter, section No. 4; and storm-water drain. Separate bids. Certified check with each bid. Harry W. Rodgers, secretary sewerage commission.

New Bedford, Mass.—September 6. Laying 3,300 feet of 60-inch pipe in Buzzards Bay. Wm. F. Williams, city engineer.

Clarksdale, Miss.—September 5, 8 p. m. Constructing 22,000 feet of 8-inch and 10-inch sanitary sewers, 2,650 feet of 18-inch to 30-inch storm sewers, manholes, flush tanks, etc.; also water works system. Certified check 3 per cent. M. W. Purnell, city clerk; W. S. Bobe, engineer.

Newburgh, N. Y.—September 5. Constructing tile pipe sewer along the open ditch on the south side of Washington Heights, about 1,400 feet. City clerk.

Port Clinton, O.—September 18, 12 m. Constructing sewer in Adam street. Certified check, $200. J. A. Singler, village clerk.

Duquesne, Pa.—September 2, 12 m. Lowering sewer in West Grant avenue and Matlack street. L. W. Francis, chairman sewer committee.

Rock Hill, S. C.—September 15. Constructing three sewage disposal plants, consisting of Imhoff tanks, contact beds, etc. Thos. Gothran, engineer.

Mitchell, S. D.—September 4, 8 p. m. Constructing lateral sewers. N. H. Jensen, city auditor.

Colonial Beach, Va.—October 11. Constructing water works and sewer system. Harry Stevens, Union Trust Bldg., Washington, D. C., consulting engineer.

Toronto, Ont.—September 12, 12 m. Constructing storm overflow sewer and high-level intercepter, in all about 10,000 lineal feet. C. H. Rust, city engineer.

CONTRACTS AWARDED.

Phoenix, Ariz.—Constructing 50 miles of sewers and appurtenances, to the American Light & Water Company, Chicago, $308,940.

Kingsbury, Cal.—Constructing water works, to Braun, Williams & Russell, San Francisco, $19,447.

Los Angeles, Cal.—Constructing sewer in Vermont avenue, to Joe Chutuk, $29,819.

San Francisco, Cal.—Constructing main sewer in Howard street, to John Daniels, $90,758; and the Healy & Tibbitts Construction Company, San Francisco, $92,254; several sections of the North Point main sewer, to Healy & Tibbitts Construction Company; section D-3 North Point main sewer to F. Rolandi.

San Mateo, Cal.—Constructing sewers and septic tank, to J. A. Wilson. San Mateo, $23,000; pumping station, to the United Iron Works, San Francisco.

Winters, Cal.—Constructing sewer system, to the Dozier Construction & Engineering Company, Sacramento, Cal., $20,370.

Colorado Springs, Colo.—Constructing sanitary sewers, to J. S. Schwartz, Colorado Springs, $18,577.

Denver, Colo.—Constructing storm sewers, to the Gaffy & Keefe Construction Co., $8,140; Denver-Pueblo Construction Company, $13,181.04.

South Norwalk, Conn.—Constructing sewers in Stuart, Fairfield and Connecticut avenues, to Streuli & Puckhafer, Bridgeport, Conn.

Washington, D. C.—Contracts for construction of sewers and pavements in Burnaby, B. C., have been awarded. The names of successful bidders and other particulars may be obtained from the Bureau of Manufactures.

St. Maries, Idaho.—Constructing the sewer system, to Hensen & Elbury, Salt Lake City, Utah, $15,000.

Berwyn, Ill.—Constructing pipe sewer on Hiawatha avenue, to David H. Airey, Morgan Park, $9,570.

North Chicago, Ill.—Constructing sewer system, to Wm. Moran & Co., Waukegan, $45,510.

Waukegan, Ill.—Constructing sewer system in Arlington Heights, to Lanyoun & Clifford, Waukegan, $74,000.

Muscatine, Ia.—Sewerage work as planned for the present summer, to the Independent Construction Company, Davenport, $4,964.64.

Valley Junction, Ia.—Constructing sanitary sewers, to George M. King Construction Company, Des Moines, $15,159; outlet and disposal plant, to George A. Mallory & Co., Kewannee, Ill., $12,329.

Waterloo, Ia.—Laying sewers in Home Park boulevard and six other streets, to the Black Hawk Construction Company.

Hoisington, Kan.—Constructing 8.2 miles of sewers and a disposal plant, to Bash & Gray, Great Bend, Kan., $35,011.

Wichita, Kan.—Constructing Douglas avenue storm sewer, to John Striffler, Wichita, $10,028.75; four sanitary sewers, to W. W. Cook & Sons, Junction City, Kan., aggregating $15,000.

Louisville, Ky.—Constructing Long avenue pipe sewer, to Koppelman & Eddy, Louisville, $1,892.

Baltimore, Md.—Constructing sewers: valve and pipe work, to the B. F. Sweeten Company, $29,093.50; building sewer, to S. K. Abbott, $998.45.

Cumberland, Md.—Constructing sewers, to Varig Construction Company, Cumberland, $18,920.

Milford, Mass.—Constructing section 8 of sewer system, to Cendella & Co., Milford, $22,306.

Pittsfield, Mass.—Constructing sewer, to David A. Dory, Natick, $23,819.

Detroit, Mich.—Completing the Fairview sewer, to John Ginzel, $32,700.

Ely, Minn.—Constructing trunk sewers, sedimentation tank and water mains, to H. L. Bartlett, Virginia, Minn., $12,000.

Eveleth, Minn.—Constructing sewers in Garfield and Elba avenues, etc., to the Pastoret-Lawrence Co., Duluth, $10,000.

Fairmount, Minn.—Constructing water mains and sewers, to J. W. Turner & Co., $13,000.

Kansas City, Mo.—Constructing sewers; 14,000 feet of sewer, to Michael Walsh, $21,461; William Mullin, $92,187; Bernard Corrigan (O. K. Creek sewer), $850,000; R. J. and Wm. Boyd, Kanas City, Kan., $22,154.

St. Louis, Mo.—Reconstructing Ferry street sewer, to Fruin-Colnon Contracting Company, St. Louis, $29,872.

Whitefish, Mont.—Constructing sewers, to Sam Odergard, Kalispell. $13,500; septic tanks, to W. A. Powers, Kalispell.

Neligh, Neb.—Constructing sewers, to Guy E. Smith, Indianola, Ia., $7,353.

Paterson, N. J.—Constructing West Paterson and Totowa sewer: Section A, to M. Kiernan & Bergin, $28,304.75; section B, to McKiernan & Bergin, $14,081.77; section C, to Frank Puglia, Paterson, $2,648.65, and Union Building & Construction Company, Passaic, $6,472.55; section D, to Frank Puglia, $4,067.40; sections E, F and G, to Union Building & Construction Company, $54,000.

Frankfort, N. Y.—Constructing sewer system, to John R. Baxter, Jr., Utica, $56,385.

North Tonawanda, N. Y.—Constructing Rumbold avenue sewer system, etc., to the Frontier Construction Company, Buffalo, $11,498.

Utica, N. Y.—Constructing Lafayette street sewer, to N. G. Peters, $4,105.32.

Chapel Hill, N. C.—Constructing sewer system, to Streater & Anderson, Gaffney, S.C.

Ada, O.—Constructing sewers, to the Van Meter Construction Company, Kenton, O., $26,000.

Akron, O.—Constructing public comfort station of stone and marble, to Hunt & Wigley, $10,000.

Cincinnati, O.—Constructing sewer in Vir-

ginia and Washburn avenues, to John E. Mahoney, Cincinnati, $6,258.

Conneaut, O.—Constructing Jackson street sewer, to Charles Hukari, Ashtabula, $5,635.

Lancaster, O.—Constructing sewer in West Sixth avenue, to Glover & Sheets, $2,867.59.

Miamisburg, O.—Constructing the Smith street sewer, to Paul & Kershner, Dayton, $14,654.

West Lafayette, O.—Constructing storm sewer system, to Trainer & Scanlon, Huntington, W. Va., $15,584; combined surface-water and sanitary sewer, to Houston & Henderson, Logan, $12,395; First and Fourth ward sewers, to L. P. Battefeld, Bucyrus, $8,152.

Youngstown, O.—Constructing storm sewer and brick pavement, to Olson & Turner, Youngstown, $16,124.50.

Altus, Okla.—Constructing sewers, to J. N. Mayfield, $25,000.

Chandler, Okla.—Constructing sewers, to Van Meter & Co., Oklahoma City, $16,600.

Oklahoma City, Okla.—Constructing sewers, to Derr & Broderick and to Reinhart & Donovan; total, $26,821.12.

Tulsa, Okla.—Constructing sanitary trunk sewer, to E. G. Pike & Co., $9,237.97; and C. O. Frye & Son, $6,688.29.

Baker City, Ore.—Constructing sanitary and storm sewers, to J. C. White.

Klamath Falls, Ore.—Constructing third unit of sewer system, to Thomas H. Simpson and E. E. Phipps, Ashland, $12,067.

La Grande, Ore.—Constructing $40,000 sewer extension, to W. H. Sutherland, Walla Walla, Wash.

McMinnville, Ore.—Constructing storm sewer, $8,828, to Dennis & Christensen.

Salem, Ore.—Constructing Union street sewer, cement pipe, to the John Construction Company, Portland, $46,678.

Crafton, Pa.—Constructing complete sewer system in West Pittsburgh Terrace section, to the Wm. Jones Company, Carnegie, $5,827.65.

Johnstown, Pa.—Constructing sewage disposal plant, to Ralston & Myers, M. Vernon, O., $13,900.

Ligonier, Pa.—Constructing sewage pumping plant and sewage purification plant, to Ralston & Meyers, Mt. Vernon, O., $13,900.

McKeesport, Pa.—Constructing East End sewer, to Bowman Bros. Co., Pittsburgh, $8,265.93.

O'lphant, Pa.—Constructing Fourth ward sewer, to B. F. O'Boyle, Dunmore, $25,000.

Pittston, Pa.—Constructing trunk sewer in Price street, to James Munley, $6,318.

Madison, S. D.—Constructing sewer system, to Meeker & Dobson, Lincoln, Neb., $28,499.

Nashville, Tenn.—Constructing seven miles of sewers, to the E. T. Lewis Co., Nashville, $279,633.

Dallas, Tex.—Constructing storm sewer on Winnetka Heights, to Joe B. Winslett, Jr., Dallas, $9,466.50.

Ft. Worth, Tex.—Constructing sewer mains, to J. W. Moore, Ft. Worth, $12,246.87.

Lubbock, Tex.—Constructing complete sewer and water system, to E. L. Dalton and Eugene Campbell, Dallas.

Norton, Va.—Constructing 6½ miles of sewers, to John Jenkins, Norton, Va., $21,322.

Seattle, Wash.—Constructing sewers in Eleventh avenue, etc., to Nelson & Carlson, Seattle, $8,350; North Sixty-sixth street, etc., to Dahlstrom & Rodal, Seattle, $21,963.60.

Seattle, Wash.—Furnishing 40,000 barrels cement for the Interbay section of north trunk sewer, to Washington Portland Cement Co. and Superior Portland Cement Co., both of Seattle.

Shelton, Wash.—Constructing 17,000 feet of vitrified pipe sewer, to McKim & Nevins, Puyallup, $9,929.

Chippewa Falls, Wis.—Constructing sewer on Grand avenue, to Fraser & Danforth, St. Paul, $5,201.

Independence, Wis.—Constructing a sewer system, to F. C. Robinson & Co., Manitowoc.

Janesville, Wis.—Constructing sewers, districts 11, 14 and 16, 350 feet, to Tubey Bros., Dubuque, Iowa.

Madison, Wis.—Constructing the first part sewer system, to Meeker & Dobson, Lincoln, Neb., $30,000.

Port Washington, Wis.—Constructing sewer mains, to Wm. Moran & Co., Joliet, Ill., $26,305.

New Westminster, B. C.—Furnishing vitrified sewer pipe, to C. Gardiner Johnson, $14,361.

Victoria, B. C.—Constructing sewer system, to Angus Smith, $99,860.

Winnipeg, Man.—Constructing sewers as follows: Trunk sewer and Mission street sewer to Van Hornback Company, $63,403 and $26,731.53 respectively; Montcalm street sewer to Hern & Knox, $1,953; various other sewers, to Felix Gottonier, aggregating $8,178.15.

CONTEMPLATED WORK.

Coronado, Cal.—The trustees have authorized the construction of sewers. W. Tilden Clark, city clerk.

San Francisco, Cal.—The board of supervisors have authorized the construction of sewers in section M, North Point main sewer, $90,000. W. R. Hagerty, clerk.

San Francisco, Cal.—The board of public works has been authorized to construct sewers in Glen Park Extension, $25,000, and North Point main sewer, $85,000, and various other sections. W. R. Hagerty, clerk board of commissioners.

Jacksonville, Fla.—The city council has ordered the laying of sewers in many streets.

Pensacola, Fla.—The city council has passed an ordinance for general sewer construction.

Quincy, Ill.—The city council has authorized the construction of sewers on Payson avenue and Spring and Oak streets, $16,300.

Belle Plaine, Ia.—The city has voted bonds for the digging of a deep well and the construction of a sewer system.

Ottumwa, Ia.—The city council has ordered the construction of sewers in Chester and Pennsylvania avenues, Willard and Ranson streets, and certain alley.

Lawrence, Kan.—The city engineer contemplates building a storm sewer through the west part of the city; paving has been ordered in Rhode Island, Berkeley, Pennsylvania and Hancock streets.

Wichita, Kan.—The city commissioners have authorized the construction of storm water and sanitary sewers, $12,000. Bert C. Wells, city engineer.

Lexington, Ky.—The board of aldermen have ordered the construction of sanitary sewer on College View avenue. J. E. Cassidy, city clerk.

Kentwood, La.—The city has voted $50,000 bonds for the construction of water works and sewer system. G. F. Conan, Brookhaven, Miss., engineer.

Caro, Mich.—The city has voted $17,500 to complete its sewer system.

Lucerne, Minn.—The city council has authorized the construction of sewers.

Minneapolis, Minn.—The city council has ordered the construction of Hopewell Hospital sewer, $75,000.

St. Paul, Minn.—The board of public works has ordered the construction of a sewer in St. Anthony avenue, $11,000.

Excelsior Springs, Mo.—The city council has ordered the extension of the main sewer. B. Van de Greyn, city engineer.

Tecumseh, Neb.—The city has voted bonds for the construction of sewers, $7,000.

Bradley Beach, N. J.—The citizens have

voted $15,000 bonds to extend the sewer system.

Edgewater, N. J.—The city has voted to construct a sewer system.

Irvington, N. J.—The town council has authorized the repairing of sewers in Fortieth street. M. Stockton, town clerk.

Albany, N. Y.—Governor Dix has signed a $500,000 additional appropriation for the construction of the West Chester county trunk sewer in the Bronx valley.

Binghamton, N. Y.—The city council has ordered the construction of sewers on Pennsylvania and Vestal avenues.

Depew, N. Y.—The village contemplates building 10,000 feet of new sewer.

Franklinville, N. Y.—The city has voted $50,000 for the construction of sewers.

Long Island City, N. Y.—The board of estimates has authorized building of sewers in Rockaway road, Panama street, Stanley avenue and Shenandoah street, $72,300.

Poughkeepsie, N. Y.—The board of public works has ordered the construction of a sewer in Fairview avenue.

St. Johnsville, N. Y.—The village board has voted to extend the sewers and water mains in William street and Failing avenue.

Syracuse, N. Y.—The board of estimate and apportionment has approved the issue of $200,000 bonds for intercepting sewer.

Akron, O.—The city council has authorized the construction of sewers in Jewett street and Sibley alley. Dow W. Harter, clerk of council.

Alliance, O.—The city council has ordered the construction of sanitary sewer No. 117 in North Union avenue. E. P. Speidel, mayor.

Bucyrus, O.—The city council has authorized the construction of various sewers.

Canton, O.—The city council has authorized the construction of sewer in Gay street. B. F. Faust, clerk.

Cincinnati, O.—The city council has ordered the construction of 12-inch, 15-inch and 18-inch vitrified pipe sewers in Waverly avenue and Blaine road. Edwin Henderson, clerk.

Cleveland, O.—The city council has authorized construction work on the Ontario street and Warren road sewers. Director of public service.

Columbus, O.—The city council has voted the construction of sewers in Cole street and in certain alleys.

East Liverpool, O.—The city council has authorized the construction of sewers in McKinnon street, Daisy alley, May street and Dover alley. C. V. Beatty, director of public works.

Findlay, O.—The city council has voted to proceed with the construction of sewers in sub-district No. 5 in district No. 2, $14,153.56. J. C. Edie, clerk.

Hamilton, O.—The council has authorized sewer work in Ludlow, Sycamore and Seventh streets. Director of public service.

Lorain, O.—The council has authorized the construction of sewers. Director of public service.

Mansfield, O.—The city council has authorized the construction of various sanitary sewers. K. P. Kroll, clerk of the council.

Massillon, O.—The city council has authorized the construction of sewers in Wooster street.

Pleasant Ridge, O.—The city has voted $20,000 bonds for the construction of a sanitary sewer system.

Salem, O.—The city council has authorized the construction of sewer in Prospect street. Jas. A. Probert, clerk.

Sebring, O.—The village council has ordered the construction of sewers in California street, Tennessee avenue, New York avenue, Eighteenth street and Twenty-first street. Harry Jenkins, village clerk.

Tiffin, O.—The city council has authorized the construction of sewer in McCollum street. J. Norton Bour, clerk.

Toledo, O.—The city council has voted to construct local sewer No. 1121. John M. Babcock, clerk of council.

Youngstown, O.—The city council has authorized the construction of sewers in West avenue, Albert street and Bernard street.

Zanesville, O.—The city council has authorized the construction of sanitary sewer in Echo avenue. Neil Starkey, clerk of the council.

Oklahoma City, Okla.—The commissioners have voted to establish four new sewer districts.

Tulsa, Okla.—The city commissioners have ordered the constructing of sewers in blocks 1, 8 and 9, Crosbie Heights. E. B. Cline, city clerk.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Eugene, Ore.—The city council has ordered the construction of sewers to cost $12,000.

Springfield, Ore.—The city council has ordered the construction of three main sewers, about $12,000.

Canonsburg, Pa.—The town council has voted to construct certain sewers. W. C. Black, secretary of the council.

Chambersburg, Pa.—The town council has authorized the construction of sewers and a sewage disposal plant.

Grove City, Pa.—The council has voted to construct a sanitary sewer in Barmore avenue and Stewart streets. L. L. McKay, borough clerk.

Harrisburg, Pa.—Samuel G. Dixon, commissioner of health, has approved plans for sewer systems in Renovo, Middletown, Throop, Lebanon and Danville.

Harrisburg, Pa.—The city council has authorized the construction of sewers in Fulton street.

Ingram, Pa.—The town council has authorized the construction of sewers in Woodbine and Stratford avenues. D. H. Hainer, secretary.

McKees Rocks, Pa.—The commissioners have authorized the construction of certain sewers.

Monaca, Pa.—The town council has authorized construction of sewers. E. B. Steiner, borough secretary.

Monessen, Pa.—The city contemplates reconstructing and extending the sewers to form a comprehensive system. J. E. Pittman, borough clerk. Alexander Potter, New Yor Citky, consulting engineer.

Pittsburgh, Pa.—The city has authorized the construction of a relief sewer in the Negley Run drainage basin; also sewers in Bates and Russell streets.

Pittsburgh, Pa.—The city council has authorized the construction of sewers in Hazelwood avenue and in Tank alley.

Portage, Pa.—The town council has authorized the construction of a general system of public sewerage. Albert G. Groke, secretary.

Verona, Pa.—The town council has voted to construct sewers in South avenue. Borough engineer.

Washington, Pa.—The town council has authorized the construction of 1,180 feet of sanitary sewer. J. F. Curran, president council.

Wilkes Barre, Pa.—The town council has ordered the construction of a 24-inch stormwater sewer. D. J. Edwards, borough secretary.

Wilkinsburg, Pa.—The borough council has authorized the construction of a sewer or culvert to enclose Nine Mile run. Borough engineers.

Bryan, Tex.—The city has voted $20,000 bonds to complete the water, light and sewer system.

Dallas, Tex.—The city commission has ordered the construction of the Lafayette line and certain storm sewers. City engineer.

Salt Lake, Utah.—The city council contemplates building an outlet sewer canal.

Kennewick, Wash.—The city council has ordered the construction of a sewer system.

Kent, Wash.—The city has ordered the construction of sewers.

Seattle, Wash.—The city council has authorized the construction of sewers in Dexter avenue, etc.; $10,000. City engineer.

Vancouver, Wash.—The city has voted $100,000 for the construction of sewers.

Thermopolis, Wyo.—The city has voted bonds for $20,000 for sewer system. J. B. Chessington, city engineer.

Chilliwack, B. C.—The American consul-general at Vancouver reports that the city contemplates the construction of a concrete pipe building plant and a sewer system.

Bridgeport, Ont.—The city has voted $8,000 bonds to complete the Bowen road sewer.

Pernambuco, Brazil.—The American consul reports that the city is installing a system of sanitary drainage.

WATER WORKS.

BIDS REQUESTED.

Dorris, Cal.—September 4. Constructing water works system.

Fresno, Cal.—September 4, 2 p. m. Constructing steel water tanks at Fresno County Orphanage. D. M. Bramwell, clerk board of supervisors.

Sawtelle, Cal.—September 7. Constructing a water-softening plant at the National Soldiers' Home. E. W. Moore, treasurer.

Canton, Ill.—September 16. Furnishing 2,000,000-gallon pumping engine and air compressor. C. R. Beam, city engineer.

Belle Plaine, Ia.—September 11. Constructing 6 miles of 4-inch to 8-inch water mains. S. H. Ferree, city clerk; Charles P. Chase, Clinton, Ia., engineer.

Decorah, Ia.—September 6. Constructing extension of water mains. F. M. Hughes, city clerk.

Burden, Kas.—September 5, 7 p. m. Constructing a water works system. Rollins & Westover, Kansas City, Mo., engineers.

Mound City, Kas.—Constructing improvements to the water works system; $25,000. P. T. Thorne, city clerk.

Battle Creek, Mich.—Constructing filter plant, capacity from 4,000,000 to 8,000,000 gallons per 24 hours. P. M. Metcalf, engineer.

Rush City, Minn.—September 5. Furnishing and installing electric fire pump and motor, fire mains, pipe, hydrants, etc. Village recorder.

Clarksdale, Miss.—September 5, 8 p. m. Constructing 59,000 feet of cast iron water mains, pumps, artesian well, compressor, etc.; also sewer system. Certified check. M. W. Purnell, city clerk; W. S. Bobo, engineer.

St. Charles, Mo.—Constructing two reservoirs and a pipe line; $30,000. City clerk.

Manhattan, Mont.—September 4, 7:30 p. m. Constructing gravity system of water supply. R. H. Dean, town clerk.

Crawford, Neb.—September 2. Furnishing 34,000 feet of wood stave water pipe, 2,000 pounds of cast iron fittings, etc. Clyde Hornby, city clerk.

Omaha, Neb.—September 6. Constructing 14-inch water main in California street; $8,000. Water board.

Grand Forks, N. D.—September 15. Furnishing 15,000,000-gallon steam pump. H. G. Lykken, city engineer.

Muskogee, Okla.—September 5. Furnishing pumping machinery for water works plant. Chas. Wheeler, Jr., city clerk.

Muskogee, Okla.—September 5, 10 a. m. Constructing a 6,000,000-gallon water purifying and softening plant; the concrete basins only at this time. Alexander Potter, 114 Liberty street, New York, consulting engineer.

Homestead, Pa.—September 4. Laying water pipes, setting fire plugs, etc. Frank Trautman, borough clerk.

Sioux City, S. D.—September 15. Sinking a new well; $12,000. S. B. Howe, city engineer.

Ft. Worth, Tex.—September 5. Constructing a dam containing about 300,000 cu. yds. of earthwork and 60,000 cu. yds. of masonry; also 6½ miles of concrete pipe. Board of engineers.

Colonial Beach, Va.—October 11. Constructing water works and sewer system. Harry Stevens, Union Trust bldg., Washington, D. C., consulting engineer.

Northfolk, W. Va.—October 1. Constructing water system, including concrete tanks and filters. City clerk.

Sparta, Wis.—September 2, 2 p. m. Constructing 4,700 feet of water main, etc. C. H. Gregory, secretary water commission.

West Milwaukee, Wis.—September 5. Constructng 5,000 lineal feet of cast iron water mains, etc. S. Brew, village clerk.

Winnipeg, Man.—September 5, 11 a. m. Supplying cast iron water pipe, f. o. b. city yards. M. Peterson, secretary board of control.

Windsor, Ont.—September 12. Constructing intake pipe and screen well. Water office, Windsor; Smith, Hinchman & Crylls, Detroit, Mich., engineers.

Montreal, Que.—October 3. Constructing filter plant, contract No. 3. L. N. Senecal, secretary board of commissioners.

Brisbane, Australia.—January 30, 12 m. Constructing Mt. Crosby pumping plant, 6,000,000 gallons capacity. Geo. Johnston, secretary metropolitan water and sewerage board.

CONTRACTS AWARDED.

Mena, Ark.—Constructing water works, to the Tonkawa Construction Company, Tonkawa, Okla., $38,000.

Maricopa, Cal.—Constructing 8-inch water pipe from Guyama Valley, 40 miles, to French Bros., Taft, Cal.

San Francisco, Cal.—Constructing 500,000-gallon steel tank, to Frederick C. Roberts & Co., $12,350.

San Francisco, Cal.—Constructing division wall of Twin Peaks reservoir, to Healy-Tibbitts Construction Co., $19,500.

Brighton, Colo.—Laying extensions to water mains, 9,000 feet, to Peter O'Brien, Denver.

Olathe, Colo.—Constructing water works, to Barnes & Stephens, Colorado Springs, $57,300.

Pueblo, Colo.—Constructing 50,000,000-gallon filter plant, to the Roberts Filter Co., Darby, Pa., $251,800.

Americus, Ga.—Constructing reinforced concrete reservoir, to A. J. Wardrep, Nashville, Tenn., $4,782.

Douglasville, Ga.—Constructing water works to J. B. McCrary & Co., Atlanta, $8,100.

Macon, Ga.—Laying 13,506 feet of pipe, with hydrants, etc., to J. B. McCrary & Co., Atlanta, Ga., $14,096.

Bloomington, Ill.—Constructing East Lawn water main system, to Frank Sullivan, Bloomington, $8,302.46.

Chicago, Ill.—Laying water pipes in various streets, to Malachy Murphy, 5315 Wabash avenue; Simon Ryan, 2927 West Congress street; Edward Connor and Carmine Roberts.

Flora, Ill.—Constructing water works, to the H. H. Hall Construction Co., St. Louis, Mo., $44,012.

Herrin, Ill.—Constructing municipal water works to the P. H. Hall Construction Co., East St. Lous, Ill., $42,072.

Pana, Ill.—Constructing water works system, to O. T. Dunlap, Edwardsville, Ill., and

the Platte Iron Works, Dayton, O., $51,200.

Council Bluffs, Ia.—Furnishing 350 tons of cast iron pipe and special castings, to the United States Cast Iron & Foundry Co., Chicago; installing water works extensions, to the Ludlow Valve Manufacturing Co., Troy, New York.

Gilmore City, Ia.—Constructing a water works plant, to C. W. Roland Co., Des Moines, Ia., $13,595.

Wall Lake, Ia.—Constructing water works, to the Des Moines Bridge & Iron Works, Des Moines, Ia., $4,750.

Williams, Ia.—Erecting steel water tank and tower, to the Des Moines Bridge & Iron Co., Des Moines, Ia.

Lynn, Mass.—Constructing dam at Breed's Pond, to E. F. Dwelley, Lynn, $40,649.

Flint, Mich.—Constructing filter plant, to the Pittsburgh Filter Manufacturing Co., $138,895.

Ada, Minn.—Digging 10-inch artesian well, to Swenson Artesian Well Co., Minneapolis, Minn.

Duluth, Minn.—Laying water and gas main, to E. A. Dahl, $16,694.

Duluth, Minn.—Laying water mains, to S. Johnson and Erick, Nordquist & Co., $15,283.20.

Easton, Minn.—Constructing 75,000-gallon steel water tank, to Des Moines Bridge & Iron Works, Des Moines, Ia., $5,690.

Eveleth, Minn.—Supplying 36 tons of 7-inch cast iron pipe and 3 valve boxes, to Jas. B. Clow & Sons, Minneapolis, Minn.

Fairmount, Minn.—Constructing water mains and sewers, to J. W. Turner & Co., $13,000.

Mankato, Minn.—Installing the East Mankato auxiliary water plant, including 50,000-gallon steel tank, 110-foot steel tower, pipe lines, pump house, pump and motor, to J. G. Robertson, St. Paul, $6,850.

Hannibal, Mo.—The city has purchased the water works plant of the Hannial Water Cbo., $275,000.

Milan, Mo.—Constructing water works system, to the Meyers Construction Co., St. Louis, Mo., $21,781.

Culbertson, Mont.—Constructing water works system, to the American Light and Water Co., Kansas City, Mo., $6,940.

Anselmo, Neb.—Constructing water works, to C. G. Empfield, Anselmo, $7,450.

Brainard, Neb.—Constructing water works system and electric light plant, to the Almo Engine & Supply Co., Omaha, Neb., $10,713.

Glen Ridge, N. J.—The borough council has authorized the purchase of the Orange Water Co. plant at $40,000.

pal water works, to Loftus, Tucker & Hall,

Farmington, N. M.—Constructing municiFarmington, N. M.; and furnishing machinery, to Hendrie & Bolthoff Supply Co., Denver, Colo. Total cost, about $50,000.

Bremen, O.—Constructing complete water works plant, to Rosser & McCroba, Wheeling, W. Va., $43,541.

Columbus, O.—Laying water mains, to the U. S. Construction Co., Columbus, $18,000; West Side mains, $8,950.

Boley, Okla.—Constructing a water works system, to F. R. Stone, Lima, O., $30,000.

Hollis, Okla.—Constructing water works, to Kennedy & Fleming, Oklahoma City.

Oklahoma City, Okla.—Constructing concrete dam at the water plant, to Reinhart & Donovan, Oklahoma City, Okla., $9,339.

Waynoka, Okla.—Constructing water and electric light system, to the Oklahoma Engineering Co., Anadarka, $24,475.

Toledo, Ore.—Constructing water system, 6 miles of pipe, to Jacobson-Bade Co., Portland, Ore., $20,000.

Falls Creek, Pa.—Constructing borough water system, to John and Henry Minns, Dubois, Pa.

Pittsburgh, Pa.—Constructing 20-inch water main, to Booth & Flinn, Pittsburgh, $7,210.25.

Pittsburgh, Pa.—Constructing reservoir for the H. J. Heinz Co. plant, to the Cummings Structural Concrete Co., McKees Rocks, Pa., $30,000.

Aiken, S. C.—Constructing water mains, to Guild & Co., Chattanooga, Tenn., $13,098.

Ipswich, S. D.—Constructing water works and fire hall, to Robinson & Few, Brookings, S. D., $20,000.

Onida, S. D.—Constructing water works, to the Des Moines Bridge & Iron Co., Des Moines, Ia.

Alvin, Tex.—Constructing complete water works system, to Randell, Lovegrove & Wyman, Houston, Tex.

Chillicothe, Tex.—Engineering and constructing a water works system, to O'Nell Engineering Co., Dallas, Tex.

Dallas, Tex.—Sinking five new wells, to Sharpe & Co., Dallas, and Faucett & Hall, Corsicana; supplying 400 tons of 6-inch water pipe, to United States Cast Iron Pipe & Foundry Co.

Lubbock, Tex.—Constructing complete water and sewer system, to E. L. Dalton and Eugene Campbell, Dallas.

Newton, Utah.—Constructing water works system, to the Wheelwright Construction Co., Ogden, Utah., $20,000.

Christiansburg, Va.—Constructing a water works system, to Wm. R. Reynolds, Chicago, Ill., $34,000.

Ft. Ethan Allen, Vt.—Constructing pump house, reservoir and pumping machinery, etc., to L. B. Jacobs, Newark, N. J., $18,396.

Rice Lake, Wis.—Constructing water works extension, about 8,700 feet of pipe, to Hays & Co., Minneapolis, Minn.

Cowley, Wyo.—Constructing water works system, to G. Jaeger, Rich Hill, Mo.

Burnaby, B. C.—The construction of water works mains has been awarded to a Vancouver firm, $154,379. The names of successful bidders and other particulars may be obtained from the Bureau of Manufactures, Washington, D. C.

Port Arthur, Ont.—Constructing reservoir dam at Current River park, to Seaman & Penniman, Port Arthur, $31,755.

Toronto, Ont.—Laying 3,000 feet riveted steel pipe, 6-foot diameter, to Roger Miller & Son, Toronto, $259,900.

CONTEMPLATED WORK.

Fayette, Ala.—The city has voted $22,000 bonds for constructing water works and sewers.

Jackson, Ala.—The city has voted $15,000 bonds for the construction of stand pipe, water mains and fire plugs.

Porterville, Cal.—The city has voted $45,000 bonds for extending water works and $15,000 for paving.

Boulder, Colo.—The city has voted $125,000 bonds for water works improvements, including the Albion dam and new construction at Silver Lake.

Washington, D. C.—The American consular service reports that the city of Salisbury, South Africa, has authorized a $600,000 loan for the construction of water works and electric light plant.

Americus, Ga.—Bonds have been issued for the construction of a reinforced concrete reservoir, $105,000.

Downey, Idaho.—Mr. S. D. Clinton requests information in regard to the purchase of wood stave pipe, metal flumes, headgates, etc.

Pana, Ill.—Bonds have been voted for new machinery for water works.

Arthur, Ia.—Bonds have been voted for the construction of a water works plant.

Belle Plaine, Ia.—The city has voted bonds for the digging of a deep well and the construction of a sewer system.

Goin, Ia.—The city has voteed bonds for the construction of water works.

Hamilton, Ia.—The city has voted $20,000 bonds for the construction of water works.

Prairieburg, Ia.—Bonds have been voted for the construction of a water works system.

Englewood, Kas.—The city has sold $20,000 bonds for the construction of water works and electric light plant.

Pittsburg, Kas.—The city has voted to buy the water works.

Syracuse, Kas.—The city has voted $30,000 bonds for the construction of water works.

Kentwood, La.—The city has voted $550,000 bonds for the construction of water works and sewer system. G. F. Conan, Brookhaven, Miss., engineer.

Frederick, Md.—The city has voted $30,000 for the construction of water works.

Billerica, Mass.—The city has voted bonds for $28,000 to extend water mains on Boston and Concord roads.

Muskegon, Mich.—The city has voted $300,000 bonds for water works improvements

Stanton, Mich.—The city has voted $10,000 bonds for the construction of municipal electric light plant and water works.

Courtland, Minn.—The city has voted $3,000 bonds for the construction of a water works plant.

Duluth, Minn.—The board of public works has been authorized to construct two 15,000-gallon tanks at Gary.

Greenfield, Mo.—The city has voted to construct water works.

Bellevue, Neb.—The city has voted $20,000 bonds for construction and maintenance of artesian wells.

Tecumseh, Neb.—The city has voted bonds for the extension of its water service; $15,000.

Omaha, Neb.—The city has voted bonds for $8,250,000 with which to buy the water works.

Upland, Neb.—The city has voted bonds to construct a water works plant.

Las Cruces, N. M.—The city has sold $75,000 bonds for the construction of water works and sewers.

Hawthorne, N. J.—The city has voted to construct water works. John A. Shea, borough clerk.

St. Johnville, N. Y.—The village board has voted to extend sewers and water mains in William street and Failing avenue.

Charlotte, N. C.—The water commissioners will purchase at once 9 miles of 24-inch water pipe. Gilbert C. White, Durham, N. C., engineer.

Cincinnati, O.—The city council has ordered the removal and re-erection of the Western Hills tanks, at a cost of not to exceed $80,000. Edwin Henderson, clerk.

Cincinnati, O.—The city council has authorized the laying of water mains to supply Madisonville; $23,000. Director of public service.

Cleveland, O.—The city council has authorized the construction of a West Side tunnel extension for the water department; $700,000. R. Y. McCray, city clerk.

Cleveland, O.—The city council has authorized the construction of a bath house in Edgewater Park; $15,000.

Magnolia, O.—The village has voted to construct water works.

Bennington, Okla.—The town has voted $20,000 bonds for the construction of water works.

Grove, Okla.—The city has sold bonds for the construction of a water works and electris light plant.

Hollis, Okla.—The city has voted $50,000 for the construction of water works.

Norman, Okla.—The city has voted $12,500 bonds for water works improvements.

Oklahoma City, Okla.—The city commissioners are making plans for an extensive new water works plant.

Pawhuska, Okla.—The city has voted $60,000 bonds for extending the water works and electric light plant.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Salem, Ore.—The state fair board has appropriated $10,000 for enlarging and extending water mains.

Pittsburgh, Pa.—The city council has authorized a $60,000 contract for a steel rising main from the Mission street pumping station; also for a turbine centrifugal pump at the Ross pumping station; also for coal and ashes handling apparatus at the Aspinwall pumping station.

Hecla, S. D.—The city has voted $8,000 for the construction of water works.

Vermillion, S. D.—The city has voted $32,500 bonds for the purchase and improvement of water works plant. Missouri Valley Engineering Co., Mitchell, S. D., engineers.

Bryan, Tex.—The city has voted $20,000 bonds to complete the water, light and sewer system.

Dallas, Tex.—The city has undertaken the construction of a reinforced concrete dam across Trinity river; $20,000. J. M. Preston, city engineer.

Dallas, Tex.—The city contemplates building water works and sewers.

Greenville, Tex.—The city has issued $35,000 bonds in addition to the $50,000 already issued for improving the water works system.

Henrietta, Tex.—The city has voted $18,000 for a dam across Little Wichita river, to form water supply lake, and a pumping station.

Ladonia, Tex.—City contemplates spending $10,000 for water works system.

Mission, Tex.—The city has voted $15,000 for the construction of water works system.

Ephraim, Utah.—The city has voted $24,000 bonds for water works. P. C. Anderson, city clerk.

Perry, Utah.—The city has voted $10,000 for the construction of water works.

Santaquin, Utah.—The city has voted bonds for the construction of water works.

Harrisburg, Va.—The city has voted $50,000 bonds for filtration plant, fire engine and school buildings.

Tenino, Wash.—The council has granted a franchise to the Tenino Light, Water and Power Co.

Grafton, W. Va.—The city council has provided for improvement of the water works system; $90,000.

Fall Creek, Wis.—The village has voted $10,000 bonds for water works.

Cardston, Alta.—The city has voted $40,000 for water works system. R. E. MacArthur, Lethbridge, Alta., engineer.

Lytton, B. C.—The American consular service reports that construction of water supply and fire system is contemplated.

Point Grey, B. C.—The city has voted $501,260 bonds for extensions and additional equipment for the water system.

Vancouver, B. C.—The American consular service reports that extensive improvements are to be made to the water system.

Mexico City.—The government has appropriated an additional $500,000 for pipe line and distributing system to bring water from Xochimilco.

BRIDGES.

BIDS REQUESTED.

Colusa, Cal.—September 5, 3 p. m. Constructing three spans of concrete bridge across the Maxwell-Colusa road. County supervisors.

Salinas, Cal.—September 6, 2 p. m. Constructing bridge and jetties, $38,000. T. P. Joy, county clerk.

Washington, D. C.—December 19, 3 p. m. Constructing a large bridge over the St. Lucia river at Montevideo, Uruguay. Bureau of Manufactures, No. 7123.

Tampa, Fa.—Sentember 6. Constructing Lafayette street bridge, concrete steel. Board of public works.

Pocatello, Idaho.—September 12. Constructing steel bridge over Bear river at McGregor's ford. County commissioners.

New Athens, Ill.—September 2, 10 a. m. Constructing reinforced concrete bridge. D. M. Fullmer, town clerk.

Decatur, Ind.—September 5. Constructing bridge on Wilshire road. H. S. Michaud, county auditor.

Laporte, Ind.—September 7, 10 a. m. Constructing bridge over Kankakee river on the county line; also concrete arch in New Durham township. F. A. Housheer, auditor Laporte county.

Lebanon, Ind.—September 4, 1 p. m. Constructing and repairing four county bridges. B. F. Herdrich, auditor Boone county.

Petersburg, Ind.—September 5, 2 p. m. Constructing 8 county bridges. John D. Gray, auditor Pike county.

Rockville, Ind.—September 5, 1:30 p. m. Repairing certain bridges. J. E. Elder, auditor Parke county.

Rockville, Ind.—September 16. Constructing a 20-foot reinforced concrete bridge Brown ford. J. E. Elder, auditor Parke county.

Kansas City, Kas.—September 11, 10 a. m. Reconstructing James street bridge over Kansas river. Frank M. Holcomb, county clerk.

Wanilla, Miss.—September 4, 2 p. m. Constructing steel bridge over Fair river on Rockport road. W. H. Speight, clerk.

Kingston, N. Y.—September 5, 11 a. m. Constructing 2 reinforced concrete arch bridges and 4 reinforced concrete girder bridges. Chas. Strauss, president board of water supply, 165 Broadway, New York City.

Fort Chester, N. Y.—September 11. Widening a masonry bridge over Byram river. Board of supervisors, Westchester county.

Wentworth, N. C.—September 6. Repairing Sepples bridge and constructing various other bridges. J. P. McMichael, clerk commissioners of Rockingham county.

Akron O.—September 6, 11 a. m. Constructing Wooster avenue bridge over Wolf creek at Barberton. Certified check $300. Charles L. Wirth, clerk county commissioners.

Cincinnati, O.—September 8, 12 m. Building culverts, bridges and retaining walls on the Clough Creek pike. Fred Dreihs, clerk county commissioners.

Lancaster, O.—September 11, 10:30 a. m. Constructing Ewing and Walnut creek bridges. Certified check, 10 per cent. Palmer Howard, county auditor.

Norwalk, O.—September 5, 10:30 a. m. Constructing Penfield and Perrin bridges, reinforced concrete. Certified check, $100 with each bid. Jay E. Smith, county auditor.

Warren, O.—September 11, 1 p. m. Constructing bridge superstructure in Park avenue, Hubbard. Certified check, $200. W. R. Harrington, clerk county commissioners.

Youngstown, O.—September 2, 11 a. m. Constructing 255-foot steel bridge over the Y. & S. R. R. on Dewey avenue. Certified check, $500. Will B. Jones, county auditor.

Greensburg, Pa.—September 6, 11 a. m. Constructing reinforced concrete bridge over Sewickley creek at Shoup's station. Certified check, 10 per cent. John D. Hitchman, controller Westmoreland county.

North Braddock, Pa.—September 5, 12 m. Constructing steel bridge and stairway over the P. R. R. at 13th street. C. A. Stewart, borough engineer.

Topton, Pa.—Constructing a reinforced concrete bridge over Toad creek. Certified check, 10 per cent. County commissioners; A. L. Rhoads, county controller.

Angleton, Tex.—September 11, 12 m. Constructing two bridges over Brazos river. J. W. Munson, county judge.

Angleton, Tex.—September 11, 12 m. Constructing wooden bridge with draw across the Chocolate river near Liverpool. Certified check, $200. M. L. Drake, Alvin, Tex., county commissioner.

Lamarque, Tex.—September 1, 4 p. m. Constructing several small bridges. E. N. Sanctuary, Galveston, engineer.

Everett, Wash.—September 11. Constructing steel bridge over Sultan river. County engineer.

Vancover, B. C., Can.—September 15. Furnishing material for suspension bridges. J. F. Griffith, public works engineer, Victoria, B. C. E. McBride, road superintendent, Vancouver.

CONTRACTS AWARDED.

Flagstaff, Ariz.—Constructing bridge across Little Colorado river, to Midland Bridge Co., Kansas City, Mo., $84,000.

Camden, Ark.—Constructing a steel bridge over the Outchita river, to the Vincennes Bridge Co., Vincennes, Ind., $41,965.

Little Rock, Ark.—Constructing concrete bridge over Swaggerty branch, to Charles Turkis.

Modesto, Cal.—Constructing 4 bridges, to the Pacific Construction Co., San Francisco, $63,262.

San Lucas, Cal.—Constructing reinforced concrete bridge over San Inez river, to Charles W. Deacon, San Luis Obispo, Cal., $33,825.

Ventura, Cal.—Constructing bridge at Santa Paula, to the Mervy-Elwell Construction Co., Oakland, Cal., $7,940; bridge at Mupu, to Charles W. Corvaley, Los Angeles, $9,568; protection work on both bridges, to Petterson & Schmidt, $12,800.

Boise, Ida.—Constructing 10 steel and concrete bridges in Ada county, to the Missouri Valley Bridge & Iron Co., Leavenworth, Kas., $19,000.

Caldwell, Idaho.—Constructing steel and concrete bridges, to J. H. Forbes & Co.: At New Plymouth, $15,875; at Fruitland, $15,795; at Letha, $15,950.

Chicago, Ill.—Constructing the Washington street bridge: Substructure, to The Fitzsimon & Connell Dredge & Dock Co.; superstructure, to the Strobel Construction Co. Total cost, $237,000.

Dixon, Ill.—Constructing 150-foot steel and concrete bridge across Green river, moving and re-erecting a 60-foot bridge and constructing a 24-foot reinforced concrete bridge, to John Devine, Dixon, Ill.

Elk Grove, Ill.—Constructing one concrete arch bridge and one reinforced concrete truss bridge, to H. S. Wetherell, Elk Grove.

Metropolis, Ill.—Constructing two reinforced concrete bridges, to J. L. Cox, Murphysboro, Ill., $5,300.

Watseka, Ill.—Constructing reinforced concrete bridge across Sugar creek, to Joseph Klein, Freeburg, Ill., $7,890.

Indianapolis, Ind.—Constructing bridge over Eagle creek at Washington street, to the Reliable Construction Co., Indianapolis, $22,466.

Mishawaka, Ind.—Constructing reinforced concrete bridge over St. Joseph river, to C. S. Copp, South Bend, Ind., $64,350.

Washington, Ind.—Constructing bridges, to the Vincennes Bridge Co., Vincennes, Ind., and to James F. Hopkins, Montgomery, Ind.

Iowa Falls, Ia.—Constructing steel and concrete bridge over the Iowa river, to the Lana Construction Co., Harlan, Ia.

Newton, Ia.—Constructing 4 bridges, to H. H. Northcott, Hesston, Ia., $5,137.

Louisville, Ky.—Constructing bridge over Salt river at West Point, to Capitol Construction Co., Columbus, O., $56,300.

Shreveport, La.—Constructing substructure of bridge across Red river between Shreveport and Bossier, to Peter McGee, Kansas City, Mo., $78,692.

Bangor, Me.—Constructing Bangor-Brewer bridge to Boston Bridge Co., $47,800.

Sharpstown, Ind.—Constructing concrete bridge over the Nanticoke river, to the Roanoke Bridge Co., Roanoke, Va., $52,229.65.

Pembroke, Mass.—Constructing reinforced concrete bridge over Pudding creek, to Powers Bros., Brockton, Mass.

Moorhead, Minn.—Constructing 2 bridges at Oakport and Ulen, to the Hopeman Construction Co.

New Ulm, Minn.—Constructing steel bridge across the Big Cottonwood river, to the Security Bridge Co., Minneapolis, Minn., $6,975.

St. Louis, Mo.—Constructing third section of the municipal bridge, to the Missouri Valley Bridge & Iron Co., Leavenworth, Kas., $52,097; fourth section, to the American Bridge Co., New York City, $427,297.

Beatrice, Neb.—Repairing Court street bridge, to Standard Bridge Co., Omaha, $2,162; concrete bridge on South Sixth street, $588.

Belvidere, N. J.—Constructing steel and concrete bridge over Pequest creek, to P. A. Hennessy, Mt. Vernon, N. Y., $7,450.

Plainfield, N. J.—Constructing a reinforced concrete bridge over Green Brook at Washington avenue, to the Ferro Concrete Co., Harrisburg, Pa., $8,390.

Abany, N. Y.—Constructing lift bridge over Lock 1, Oswego canal at Bridge street, Phoenix, to Lupper & Remick, Buffalo, $13,238.

Lowville, N. Y.—Constructing a concrete arch culvert over Mill creek, to John Fitzgerald, Sacket Harbor, N. Y., $8,777.

Massena, N. Y.—Constructing concrete-steel arch bridge, to Pratt & Phillips, Watertown, N. Y., $27,625.

Warsaw, N. Y.—Constructing steel bridge, to the Warsaw, Wilkinson Company, $2,795.

Fargo, N. D.—Constructing metal culverts in Cass county, to the North Dakota Metal Culvert Co., Fargo.

Cincinnati, Ohio—Constructing substructure Gilbert avenue viaduct, to Cranford Construction Co., Cincinnati, $50,160; superstructure of reinforced concrete, to Kaps-Brehme Co., Cininnati, $144,999.

Hamilton, O.—Constructing canal bridge, to Al S. Fox, Dayton, $7,562.

Pomeroy, O.—Constructing bridge across Leading creek, to the Capitol Construction Co., Toledo, Ohio.

Spiro, Okla.—Constructing 250-foot steel span highway bridge, to the Missouri Valley Bridge and Iron Works Co., Leavenworth, Kan. S. L. Brock, superintendent.

Norristown, Pa.—Constructing stone arch bridge over Park Run, to J. M. Smith, Perkeomen, Pa.

Pittsburg, Pa.—Constructing steel work on Union bridge, to American Bridge Co., $297,792; concrete span of Atherton avenue bridge, to O. M. Driver, $91,379.54.

Pittsburg, Pa.—Constructing the Allegheny Beaver county bridge over Sewickley creek, to the Capitol Construction Co., Columbus, O.

Pittsburg, Pa.—Constructing masonry of the steel bridge over the Monongahela river near New Geneva, to McMinamim & Sims, Arcade Bldg., Philadelphia.

Stowe, Allegheny County, Pa.—Constructing concrete foundations for foot bridge over P. & L. E. R. R. from Island avenue to Nichol avenue, to Frank Bryan.

Williamsport, Pa.—Constructing ten-span steel bridge over the Susquehanna river, to the Massillion Bridge and Structural Irion Co., Massillion, Ohio, $33,000; and substructure to the Leonard Engineering Co., New York, $9,370.

Memphis, Tenn.—Construction of subways in Rayburn boulevard and Mississippi avenue, to F. D. Harvey & Co., Memphis, $50,000.

Fort Worth, Tex.—Constructing two steel bridges, with concrete piers, etc., to Austin Bros., Dallas, Tex., $14,800.

Houston, Tex.—Constructing Main street viaduct, to the Carmichael Co., St. Louis.

Richmond, Tex.—Constructing two steel bridges across the Brazos river, at Thompson and Orchard, to the Missouri Valley Bridge Co., Leavenworth, Kan., $48,500.

Roanoke, Va.—Constructing bridge over Roanoke river at Eighth avenue, to Roanoke Bridge Co., $32,300.

Fairchild, Wis.—Constructing steel and concrete bridge, to William Meyers, Mondovi, Wis.

Hudson, Wis.—Constructing steel-span bridge across Lake St. Croix, to the Central States Bridge Co., Indianapolis, Ind., $29,000.

Edmundton, Alta.—Constructing piers and abutments for the steel bridge over the Saskatchewan river, to Cannell & Spencer, Edmundton; for steel work, to the Dominion Bridge Co., Montreal.

Victoria, B. C.—Constructing a suspension bridge at Churn creek, to C. Gardiner Johnson & Co., Vancouver.

Ottawa, Ont.—Constructing steel and concrete bridge over the Rideau river, to Mr. Cameron, Cumberland, Ont., $40,000.

CONTEMPLATED WORK.

Pasadena, Cal.—The city contemplates building a $200,000 bridge across Arroyo Seco.

Hartford, Conn.—Bids will soon be asked by the board of contract and supply for constructing a steel girder bridge, $5,000. R. W. Clark, city engineer.

Wabash, Ind.—The county commissioners have appropriated $30,000 for constructing a bridge over the Wabash river at Huntington street. J. P. Noftzger, auditor Wabash county.

Shreveport, La.—$100,000 bonds have been voted to build steel buildings for the Louisiana State Fair.

Fitchburg, Mass.—The city council has ordered the readvertisement of the Fifth street viaduct contract.

Mankato, Minn.—The county commissioners contemplate the repair of various bridges.

Beatrice, Neb.—The county supervisors have ordered the reconstruction of the steel wagon bridge over Blue river at Iron Mountain. Practically every bridge along Bear creek for eight miles was destroyed by the recent floods.

Bethlehem, N. Y.—The assembly has passed a bill appropriating $100,000 for the construction of a boulevard and viaduct from Albany to Bethlehem.

Fulton, N. Y.—The city and state authorities have authorized the construction of the Broadway bridge.

Barberton, Ohio—The county contemplates building a bridge over Wolf creek on Wooster avenue, $6,000.

Cleveland, O.—The city council has authorized the improving and repairing of Central viaduct, $250,000, and the construction of the Praha S. E. bridge, $15,000. R. Y. McCray, city clerk.

Klamath Falls, Ore.—The county contemplates building a new bridge over Klamath river on the Ashland road.

Pittsburg, Pa.—The city council has authorized the construction of the Atherton avenue bridge, $100,000.

Reading, Pa.—The county commissioners have authorized the construction of the Penn street bridge.

Providence, R. I.—The board of park commissioners has selected plans for a bridge at South Park, to cost about $20,000. Corbett & Higgins, architects.

Sioux Fallls, S. D.—The city commissioners have ordered the construction of a $40,000-bridge over the Big Sioux river at Eighth street. Starke Bridge Co., Des Moines, Ia., engineers.

Rogersville, Tenn.—The county commissioners have authorized the construction of a bridge over Holstein river, $20,000.

Cotulla, Tex.—The county commissioners have authorized the building of a bridge

over the Nueces river at Ernest Lake crossing.

Centralia, Wash.—The city will build a concrete bridge across Main street ditch by day labor, $1,200.

Lachine, Que.—The Federal Parliament has voted $80,000 for the construction of a bascule bridge over the Lachine Canal, department of engineers.

STREET LIGHTING.

BIDS REQUESTED.

Jacksonville, Fla.—Sept. 4, 3 p. m. Constructing municipal power station building; also removing and re-erecting two condensing equipments; also removing and re-erecting two 1,500 kw. turbo generators. Certified check with each bid. W. M. Bostick, Jr., chairman board of bond trustees.

Jacksonville, Fla.—Sept. 4, 3 p. m. Furnishing and erecting switchboard, lightning arresters, and sub-station switchboard for the municipal electric plant. Certified check, $1,000. W. M. Bostwick, Jr., chairman board of bond trustees.

St. Paul, Minn.—Sept. 7. Furnishing 4,100 gas lamp heads, 1,400 gasoline lamp heads, and 1,400 posts; also maintenance of these lamps. Oscar Claussen, commissioner of pubic works.

Oneida, N. Y.—Sept. 15. Lighting streets and public places for one, three and five years. Albert Morris, chairman board public works.

Lima, O.—Sept. 15, 12 m. Furnishing boilers, engines, generators, etc., for municipal power station. George E. Whitney, secretary commission.

Honea Path, S. C.—Sept. 1.—Constructing water works and electric light plant, $37,000. John F. Monroe, chairman board of public works.

CONTRACTS AWARDED.

New Britain, Conn.—Constructing extension to the subway in Arch street, to the Safety Insulation Wire and Cable Co., New York City, $20,070.

Washington, D. C.—Constructing power plant at the Mare Island Navy Yard, Cal., to John W. Danforth & Co., Buffalo, N. Y., $104,420.

Boise, Ida.—Furnishing electric light to the city for seven years, to the Idaho-Oregon Light and Power Co., $126,000.

Quincy, Ill.—Installing 118 ornamental lamp standards, to the J. W. Turner Construction Co., Des Moines, Ia.

Independence, Ia.—Furnishing new equipment for light and power plant, to the Allis-Chalmers Co., Milwaukee, Wis., $11,000.

Newton, Ia.—Constructing municipal electric light plant, to Eastman & Stines, Newton. $13,700.

Greensburg, Kan.—Constructing power house for the municipal electric lighting system, to J. G. Hewitt.

Shreveport, La.—The city council has authorized a contract with the Shreveport Gas, Electric Light & Power Co., for lighting the streets for six years.

Crisfield, Ind.—Furnishing city lights, to the Crisfield Ice Manufacturing Co., for five years, $1,400 for 100 lights each year.

Escanaba, Mich.—Constructing municipal gas plant, to F. W. Freese, Ft. Wayne, Ind., $25,000.

Browns Valley, Minn.—Constructing electric light plant, to the Minneapolis Steel and Machinery Company, $10,950.

Livingstone, Minn.—A franchise has been granted to the Mineral Point Power and Electric Co., to light the village.

Brainard, Neb.—Constructing electric light plant and water works system, to the Almo Engine & Supply Co., Omaha, $10,713.

Wymore, Neb.—Constructing distributing and street lighting system, to the Columbian Electrical Co., St. Joseph, Mo., $8,303.

Newark, N. J.—Installing electric lights in Union township, to the Public Service Electric Light Co. Ninety lights for one year, $20 each.

Mandan, N. D.—Constructing municipal electric light plant, to G. W. Haggert, Fargo, N. D., $75,000.

Valley City, N. D.—Supplying electric lamps for the city, to Bryan-Marsh Co.

Canal Dover, O.—Furnishing forty street lights, with certain conditions, to Selder & Hayes, $12,000 per year.

Mt. Vernon, O.—Installing feeder wires and yard lights for the Ohio State Sanitorium, to Erner Hopkins Co., Columbus, O., $10,299.

Newark, O.—The plant of the Licking Light and Power Co., has been sold to the American Gas and Electric Co., H. L. Montgomery, Auburn, N. Y., will be general manager.

Waynoka, Okla.—Constructing electric light plant and water plant, to the Oklahoma Engineering Co. Anadarko, Okla., $24,475.

McKeesport, Pa.—Furnishing city lighting for five years, to the Monongahela Light Co., at the rates now paid.

Smithton, Pa.—The city has granted a franchise to the Smithton Light, Heat and Power Co., for city electric lighting.

Wilkes-Barre, Pa.—Lighting lanes and alleys with gas and naptha lights for three years, to the Welsbach Company.

Brookings, S. D.—Furnishing electric lamps, to the Bryan-Marsh Co.; transformers, to the Fort Wayne Electric Works; and wattmeters to the General Electric Company.

Sioux Falls, S. D.—The two electric light and power plants have been purchased and merged into one by H. M. Byllesby & Co.

Ft. Flagler, Wash.—Installing electric lighting system to the W. E. Chase, Eng. Co., Spokane, Wash., $29,000.

Seattle, Wash.—Furnishing electric meters, to Burton R. Stare, $40,928.36.

Tacoma, Wash.—Installing lighting system in the court house, to Caldwell Bros., about $3,000.

Walla Walla, Wash.---Furnishing power and light to the city for ten years, to Pacific Power & Light Co.

McMechen, W. Va.—Street lighting, to the Ohio Valley Electric Co., Benwood, W. Va.

CONTEMPLATED WORK.

Washington, D. C.—The American consular service reports that the city of Salisbury, South Africa, has authorized a $600,000 appropriation for the construction of electric light and water supply plants.

Hazlehurst, Ga.—The city has voted $5,000 bonds in addition to the $30,000 already voted for electric lighting plant.

Mascoutah, Ill.—The city has voted $12,000 bonds for the construction of municipal electric light plant.

Paxton, Ill.—The city has voted $17,000 bonds for the construction of an electric light plant.

Kansas City, Kan.—The city commissioners have approved plans for $650.000 municipal light plant. James Cable, commissioner of water and light.

Independence Ia.—The city council has voted $11,000 for electric light and power plant.

Ness City, Kan.—The city has voted $16,000 for the construction of an electric light plant.

Syracuse, Kan.—The city voted $10,000 for electric light plant.

Stanton, Mich.—The city has voted $10,000 bonds for the construction of municipal light plant and water works.

Minden, Neb.—Bonds have been voted for the construction of a municipal electric light plant, $15,000.

Middleton, O.—The city council has ordered the installation of new electric lights on two streets.

Payne, O.—The town has voted $17,000 bonds for water works, and $9,700 bonds for electric light plant.

Salem, O.—The city council contemplates installing new street light distributing system.

Pawhuska, Okla.—The city has voted $10,000 for improving electric light system.

Eugene, Ore.—The city water board will purchase poles for the city lighting system.

Altoona, Pa.—The Penn Central Light & Power Co., have taken over a number of small electric lighting companies in Cambria county, with the intention of furnishing current from plants at Warrior's Ridge and Altoona.

Falston, Pa.—The town council has granted a franchise to the Beaver River Fall Co., for electric lighting.

Philadelphia, Pa.—The city is installing many new street lights. James MacLaughlin, chief electrical bureau.

Pittsburg, Pa.—The city council has authorized the installing of additional equipment at the municipal electric light plant on the north side.

Plankinton, S. D.—A franchise for installing an electric light plant has been granted to W. A. Kuntze.

Greenville, Tenn.—The city has voted $25,000 bonds for water works and electric light plant.

Bryan, Tex.—The city has voted $20,000 bonds to complete the water, light and sewer system.

Walla Walla, Wash.—The city clerk will advertise for bids for furnishing electrical power for the arc and cluster lights in the city for five and ten-year periods.

Fond du Lac, Wis.—The city council has voted to install ornamental electric lights in Main street.

Random Lake, Wis.—The city has voted to construct an electric light plant.

Kamloops, B. C.—The American consul-general at Vancouver reports that the city is contemplating the construction of a hydro-electric plant to cost about $200,000.

Hamilton, Ont.—The city has voted $504,000 bonds for the construction of municipal light and power plant.

Port Stanley, Ont.—The city has voted $12,750 for the purchase of an electric light plant and installation of distributing system.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

New York, N. Y.—Sept. 7, 12 m. Furnishing labor and materials for removing snow and ice in the boroughs of Brooklyn, the Bronx, and Manhattan. W. H. Edwards, commissioner of street cleaning.

CONTRACTS AWARDED.

Virginia, Minn.—Constructing 25-ton garbage incinerator, to the Decarie Incinerator Co., Minneapolis, Minn. $23,700

Atlantic City, N. J.—Collecting garbage for five years, to the Atlantic City Product Co., $248,000.

Muskogee, Okla.—Constructing garbage disposal plant, to Lewis & Kitchen, Kansas City, Mo.

CONTEMPLATED WORK.

Bloomington, Ill.—The city council has ordered the advertising of a contract for hauling garbage for one year. Harry E. Rhoads, city clerk.

Toledo, O.—The city council has authorized the sweeping and sprinkling of certain streets. John M. Babcock, clerk of council.

Charleroi, Pa.—The town has voted $65,000 for street improvement, a garbage plant, and a municipal building.

Monongahela, Pa.—The city has voted $10,000 bonds for the construction of a garbage crematory.

FIRE APPARATUS.

BIDS REQUESTED.

New York, N. Y.—Sept. 5, 10:30. Constructing extension of underground fire alarm telegraph system on East End avenue. Fire commissioner.

East Cleveland, O.—Sept. 8. Installing complete combination fire and police signal systems. Certified check, 10 per cent. Kline F. Leet, city clerk.

Seattle, Wash.—Sept. 1, 10 a. m. Furnishing various fire fighting apparatus. Certified check with each bid. C. B. Bagley, secretary board of public works.

Winnipeg, Man.—Sept. 25. Furnishing fire fighting equipment. Chief of fire department, central fire station.

CONTEMPLATED WORK

Stockton, Cal.—The city contemplates buying a motor driven hose wagon and fire engine, and a motor driven hose wagon and chemical engine.

Washington, D. C.—The bureau of manufactures reports a request from a business house in the West Indies for information about fire fighting equipment for four large cities. Bureau of Manufactures, No. 7209.

Honolulu, H. I.—The city and county board of supervisors contemplate the purchase of two auto fire trucks for chemical apparatus, to cost about $6,000 each.

Louisville, Ky.—The board of public works contemplates installing an extensive underground fire alarm system.

Boston, Mass.—The city contemplates the purchase of motor driven fire fighting equipment.

Eveleth, Minn.—The city contemplates the construction of a fire hall.

Minneapolis, Minn.—The city council has ordered the construction of a fire engine house in the Lake Harriet district.

Minneapois, Minn.—The city council has ordered the purchase of two auto trucks for the water department.

Tulsa, Okla.—The city has voted $291,000 bonds for the construction of water works, sewers, fire department, street improvements, etc. E. B. Cline, city clerk.

Braddock, Pa.—The council has authorized the purchase of two automabile chassis for the fire department.

McKees Rocks, Pa.—The commissioners have authorized the purchase of 2,000 feet of fire hose.

Narragansett Pier, R. I.—The town council has voted to purchase a horseless steam fire engine. Howard Caswell, chief.

Harrisonburg, Va.—The town has voted $50,000 bonds for fire engine, water works improvements, etc.

Everett, Wash.—The city contemplates the purchase of a $6,000 chemical auto fire engine, a $9,000-engine and hose auto, and a chemically equipped runabout, also additional fire boxes, etc.

Seattle, Wash.—The city council has authorized the purchase of certain apparatus and supplies for the fire department.

MUNICIPAL ENGINEERING

VOLUME XLI NUMBER THREE

SEPTEMBER, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

GENERAL CHARGES—Continued.

FIRE insurance is not of great importance to the contractor, but as it is often required it is well to know that the rate is one-fourth to one-half of one per cent. per annum, short rate. That is, this rate will be proportioned for the actual time of construction. Many times arrangements can be made to join with the owner in a regular standard three-year term policy whereby the insurance during construction may be carried at much less expense.

GENERAL EXPENSE ITEMS.

General expense items are many and various. Into this classification are thrown all of the items which are at all times uncertain as to cause and nature. In general, expense items consist properly of accessory materials, repair items of small character, such as for petty tools, and for supply features of any contract. The main items are indicated by the following list:

TABLE II.

GENERAL EXPENSE ITEMS, INCLUDING REPAIRS TO PETTY TOOLS.

Use for distribution of invoices, charging to contract for which purchased.

Belt laces	Funnel
Boiled oil	Handles
Bolts	Hasp
Boiler paint	Hinges
Brushes	Hooks
Brooms	Keys
Building paper	Lag screws
Burlap	Lantern globes
Butts	Level glasses
Cable clamps	Livery hire
Caps and fuse	Locks
Chalk	Mortar color
Clips (rope)	Molds
Drift bolts	Metal
Dynamite	Nails
Emery cloth	Nozzle
Nuts	Snaths
Oakum	Spikes
Paint (all kinds)	Sprinklers
Paint pots	Steel brushes
Paraffine	Strainer
Pitch	Tapes
Powder	Tar
Putty	Telephone
Rope	Tin
Rents	Track bolts
Rivets	Track spikes
Roofing felt	Turpentine
Roofing material	Washers
Roofing paper	Wheels
Roofing tin	White lead
Rollers	Wicks
Rosin	Wire
Sand paper	Wire cloth.
Screws	Etc., etc.

General expense items really have no salvage value and are a direct charge against each job. The aggregate cost of such items is of no small consequence, as is shown by the following Table III, giving results on some twenty-one jobs. The first item was on a job where the pay roll represented approximately 50 per cent. of the cost. Therefore this general expense cost represented 8.65 per cent. of the entire cost of material and labor. Sometimes we would be satisfied with such an amount as a profit.

TABLE III.

GENERAL EXPENSE COST. METHOD BY PERCENTAGE OF PAY ROLL.

38	17.3	Brg. piers—wet
71	17.0	Drag line excav.
45	11.2	Con. brg.—dry
39	9.7	Con. brg.—dry
93	9.7	Con. brg.—small
40	9.4	Con. wall (wet) and dredging
39	8.5	Wall—wet
72	8.3	Ballast excav.
63	7.7	Series con. brgs.
55	6.7	Con. brg.

96	6.4	Con. viaduct
48	5.8	Interurban (complete)
56	5.6	Interurban (complete)
98	5.2	Pile driving
49	5.0	Sewer
64	5.0	Intake
62	4.6	Con. arch
53	4.0	Con. wall
69	3.7	Con. wall
97	2.8	Dredging
92	2.1	Dredging
90	1.7	Sewer (special)

This table is naturally of much more value to the author than to any reader, because the Index number furnishes the key to open up a mental picture of each job and its peculiar features. Such a table of rates cannot be absolute, but requires experience and judgment in the use thereof. It is, however, no different than the liability company's schedule of rates (Table I), where slight differences in the kind of work or the conditions under which done make changes in the rates.

PETTY TOOLS.

Nothing with which the contractor must contend is more exasperating than the loss, breakage, stealing and carelessness in handling of small and petty tools. The item cannot be considered as strictly applying to any one job but better as a general loss determined by several years' experience.

Table V, following, shows how this cost fluctuates as a percentage of the pay roll, but it is advised that the average be used, as jobs overlap; and one job may profit by stock on hand, whereby another may lose on account of new purchases. The term, however, is an absolute general charge cost and should not be overlooked.

The method of percentage to pay roll is especially applicable, as the labor employed uses the tools and is directly a measure of the amount necessary.

TABLE IV.

PETTY TOOL ITEMS.

Use for distribution of invoices, charging to contract for which purchased.

Anvils	Blocks (iron and wood)
Augers	Cables
Axes	Canthooks
Bars	Car movers
Bellows	Car replacers
Bits	Chain tongs
Boiler tools	Chains
Boring machine	Chain blocks
Brads	Chalk line
Brooms	Chisels
Brushes	Derrick blocks
Buckets	Dies
Bush hooks	Dipper
Dolly	Rasp
Drill	Reamers
Drags	Riddles
Files	Rope Blocks
Forks	Rope Guys
Flue cleaner	Salamanders
Flue expander	Saws
Flue roller	Scoop
Forges	Scrapers
Grindstone	Screen
Hatchets	Scythes
Hammers	Sheeting cups
Hand axes	Sheeting pullers
Hand pumps	Sheaves
Hods	Shovels
Hose (water)	Sledges
Jacks	Spades
Lanterns	Spike pullers
Levels	Squares
Mattocks	Stencils
Mauls (iron and wood)	Stone hooks
Nippers	Stone dogs
Picks	Tanks
Pile caps	Tampers
Pinchers	Tongs
Pipe cutters	Tool boxes
Pipe dies	Torches
Pipe vise	Track tools
Pitcher dump	Trench pump
Planes	Trucks
Plaster hooks	Trowels
Plaster trowel	Wagon pumps
Plug and feathers	Well pumps
Plumb bob	Wedges
Punchers	Wheelbarrows
Push brooms	Wire clippers
Push carts	Wire rope
Plyers	Wrenches.
Rackets	

There is a salvage in Petty Tools which should be taken care of by debiting the Yard account, which account is in turn credited when the tools are sent out on a new job. It is for this reason that the general average loss is recommended for use as a General Charge, although each job should be charged the full amount expended for this item. The salvage is low grade and of but slight cash value.

TABLE V.

PETTY TOOL COST. METHOD BY PERCENTAGE OF PAY ROLL.

Bridges	7 jobs	2.6
Viaducts	2 jobs	2.0
Interurban Ry's	2 jobs	2.0
Sewers	3 jobs	2.0
Walls, etc.	4 jobs	2.6
Pile driving and Drag line excav.	6 jobs	3.7
Buildings	18 jobs	1.8
General average		2.14

FUEL AND OIL.

Fuel and oil is a direct charge to the work, and whether the amount is large or small depends on the kind of work

and the difficulties encountered. Fuel and oil will be much more of an item for a concrete bridge pier, requiring pumps, derricks, hoisting engines, pile drivers, mixers, etc., than for a concrete pavement, although the concrete itself may be of approximately the same cost for materials, but not for labor. Therefore, as in other items of general charge, the fact is brought out that the pay roll is the best indication of the work, and fuel and oil should be apportioned by a percentage thereof.

The items going to make up this division are as follows:

TABLE VI.

FUEL AND OIL ITEMS.

Including any costs or bills pertaining to the production of power. Use for distribution of invoices, charging to contract for which purchased.

Barrel	Engine oil
Battery	Gasoline
Belt dressing	Grease
Boiler compound	Oilers
Cans	Oil faucet
Coal	Oil gate
Coal oil	Packing
Cylinder oil	Power bills
Dope	Tallow pots
Dry cells	Valve oil
Dynamo oil	Waste
Electrical connections	

TABLE VII.

FUEL AND OIL COST. METHOD BY PERCENTAGE OF PAY ROLL.

Bridges	7 jobs	7.00
Viaducts	2 jobs	1.60
Interurban Ry's	2 jobs	5.70
Sewers	2 jobs	1.40
Walls, etc.	4 jobs	4.50
Pile driving		
Drag line excav.	6 jobs	7.20
Buildings	18 jobs	1.4

FITTING AND REPAIR ITEMS.

All expense items for material as labor or bills for repairs when chargeable to maintenance of plant or equipment should be charged to this account.

The idea is to distinguish between expense items directly connected with the particular job and those items which pertain to the general up-keep of machinery. The items ordinarily encountered are as per the following list:

TABLE VIII.

FITTING AND REPAIR ITEMS.

Use for distribution of invoices or labor cost charging to contract upon which equipment is being used.

NOTE: It might seem proper to make this a general charge over all jobs but experience shows that this class of supplies are lost, stolen or damaged every time a move is made and, therefore, the job should stand the loss and consequent charge.

Asbestos.	Machinery Fittings.
Babbitt Metal.	Machinery Repairs.
Boiler Tools.	Nipples.
Boots.	Pipe , 3 inches and less.
Bushings.	Plugs.
Cable Clamps.	Pipe Fittings.
Clips.	Reducers.
Cocks.	Shaft Collars.
Couplings.	Shafting.
Cross-head Pins.	Shape Iron.
Faucets.	Springs.
Flues.	Steam Hose.
Gaskets.	Syphons.
Gauges.	Threading.
Grates.	Unions.
Grease Cups.	Valves.
Hose, steam.	Water Glass.
Injectors.	Wheels.
Iron and Steel.	Etc., etc.
Jet.	
Lubricators.	

TABLE IX.

FITTINGS AND REPAIR COST. ILLUSTRATED BY PERCENTAGE OF PAY ROLL.

Bridges	7 jobs	1.70
Viaducts	2 jobs	.70
Pile Driving and Drag-line Excavation	6 jobs	4.40
Inteurban Ry's	2 jobs	4.20
Sewers	2 jobs	1.30
Walls, etc.	4 jobs	1.50
Buildings	18 jobs	.67

COMMISSARY EXPENSE.

Many times it is necessary to maintain a commissary for its proper care of men. This may be in the nature of an established camp of shacks or huts, or it may be of wagons or trains, moving from job to job. This latter case is applicable to small jobs along a railway line. The items to be charged to this account will appear many times in jobs where a job commissary is not existent. For this reason and because of the particular character of the items it would seem desirable to maintain a commissary charge on all work. The items are as follows:

TABLE X.

COMMISSARY EXPENSE ITEMS.

Desk.	Eatables.
Bedding.	Knives and Forks.
Boots.	Lamps.
Candles.	Pots.
Canvas.	Stoves.
Cooking Utensils.	Table Furnishings.
Cots, etc.	Tarpaulins.
Covers.	Tents, etc., etc.

CONTRACTING PRACTICE. PLATE IX

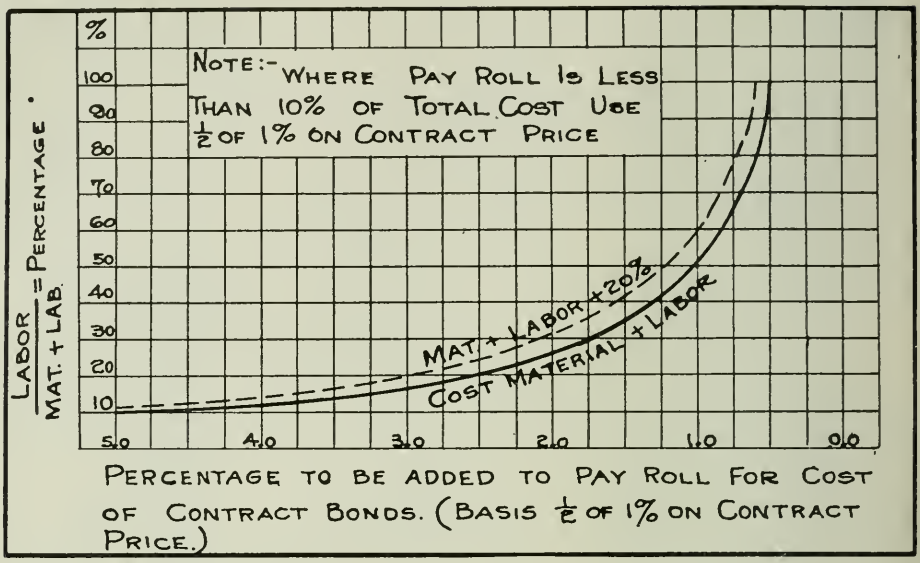


TABLE XI.

COMMISSARY COST—METHOD BY PERCENTAGE AT PAY ROLL.

1st. Permanent Camps, average..3.50%
2d. Moveable camps, average....7.00%

INTEREST.

Assume a contract of $100,00 to be completed in ten months or at the average rate of $10,000 per month. Payments are to be made during the progress of the work to the extent of 85% payable the 15th of the month following that within which work is done. Final payment 60 days after completion. Also assume profit is at the rate of 10% on cost.

In the first place at the rate of $10,000 of work per month the actual cost is approximately $9,000.00, leaving $500.00 per month in the hands of the client. Then since one-half month's work on current month elapses before payment is made for preceding month, $4,500.00 is expended for cost of work. Under these conditions, even if the contractor can buy material on 60 days, his pay roll will come weekly and his average time for bills due is 30 days, so that he is always in arrears and paying interest on the amount held up in excess of profit and for work done and not yet payable. This charge will amount to ½ of 1% to 1% on the total cost, depending on his credit standing in purchase of materials.

The maximum cost is reached where no work is paid for until completed and accepted. In a case of this kind full interest plus a bonus or fee should be added to the estimate, as no capitalist can afford to speculate on financing work of this kind without receiving at least double the ordinary legal interest for money.

The time necessary to complete work or during which payment is withheld will naturally affect the charge.

MACHINERY AND EQUIPMENT.

Machinery and equipment can either be considered an investment or an expense item.

In the first case a reasonable interest or rental return should be expected, which may be included in profit. In the second case a rental or depreciation should be charged out direct to the job.

Fittings and repair account, Table VIII and IX, are supposed to take care of wear and tear due directly to the particular job, so that only general depreciation can be considered under this heading.

If no machinery is purchased for any job one-third to one-half may be charged out at once as depreciation, so far as cash return may be expected.

As the amount of equipment varies with the character of work, the above hints are offered only as suggestions in order that this item of general charge cost may not be overlooked.

GENERAL OFFICE AND SUPERVISION.

This general charge cost not only varies with the character of work, but also with the volume of work and the magnitude of the organization. The cost exists even if a contractor has no office but his "hat", for he must have some expense. This charge is constant, work or no work, and the amount to be allowed is a matter of individual judgment.

Forms of Municipal Government in Europe.

By Robert W. Speer, Mayor, Denver, Colo.

THE Boston Chamber of Commerce organized a party which spent the summer months in a study of municipal and trade conditions in Europe, and returned to this country late in August. In the party were several representatives of municipalities in various parts of the country, who have made full reports to their own cities and to associations and business organizations. These have been reported more or less fully in the papers and magazines throughout the country and should result in much good, through the comparison of results and methods.

One of the most comprehensive and clear of these reports is that made by Mayor Robert W. Speer of Denver, Colo., at a banquet of the Colorado Electric Co., held in his honor. By courtesy of Mayor Speer his address is given with illustrations from the many photographs which he brought home with him. It is a very satisfactory presentation of the matters from which lessons may be drawn by our American cities. The address reads as follows:

My trip over twenty of the most progressive cities in Europe has demonstrated to my satisfaction that the beauty and the business of a city can be made to work in harmony, and to assist each other. Beauty helps business, and business can be made to stimulate and encourage beauty. It was my first trip abroad, and, therefore, full of interest. It was very educational, broadened my views, removed many false impressions, and will ever act as an inspiration to work for a greater and more attractive Denver. No one can travel in Europe and study municipal life without realizing that we have much to learn.

I have not the time tonight to go into details as I would like to do, but will confine myself to general statements as to how European cities are governed, and largely, let you make your own application as to Denver. In order to understand the government we must always bear in mind that European cities have greater power, more freedom of action, than American cities. We boast of our individual liberty, but our cities are bound hand and foot by laws. Here a city can only do what it is specially authorized by law to do, while in Europe cities can do anything that the law does not specially prohibit them from doing.

I found the voting franchise for municipal elections more or less limited in all the countries visited.

In England only property and rate-paying citizens can vote for city officials. The long residence required in districts or wards prevents much of the floating population from voting. Restrictions are not so great in other elections, and a much larger vote is cast. The officials of Liverpool told me that not over 40 to 50 per cent. of their people voted in municipal elections.

In Belgium every man has one vote. If a man is married, has children and pays taxes, he has two votes. If he holds a diploma from a high school he has three votes.

In Austria-Hungary the taxpayers paying the highest taxes elect one-third of the city couuncil. The middle class, professional men, tradesmen, etc., elect another one-third, while the mass of small taxpayers elect the other one-third.

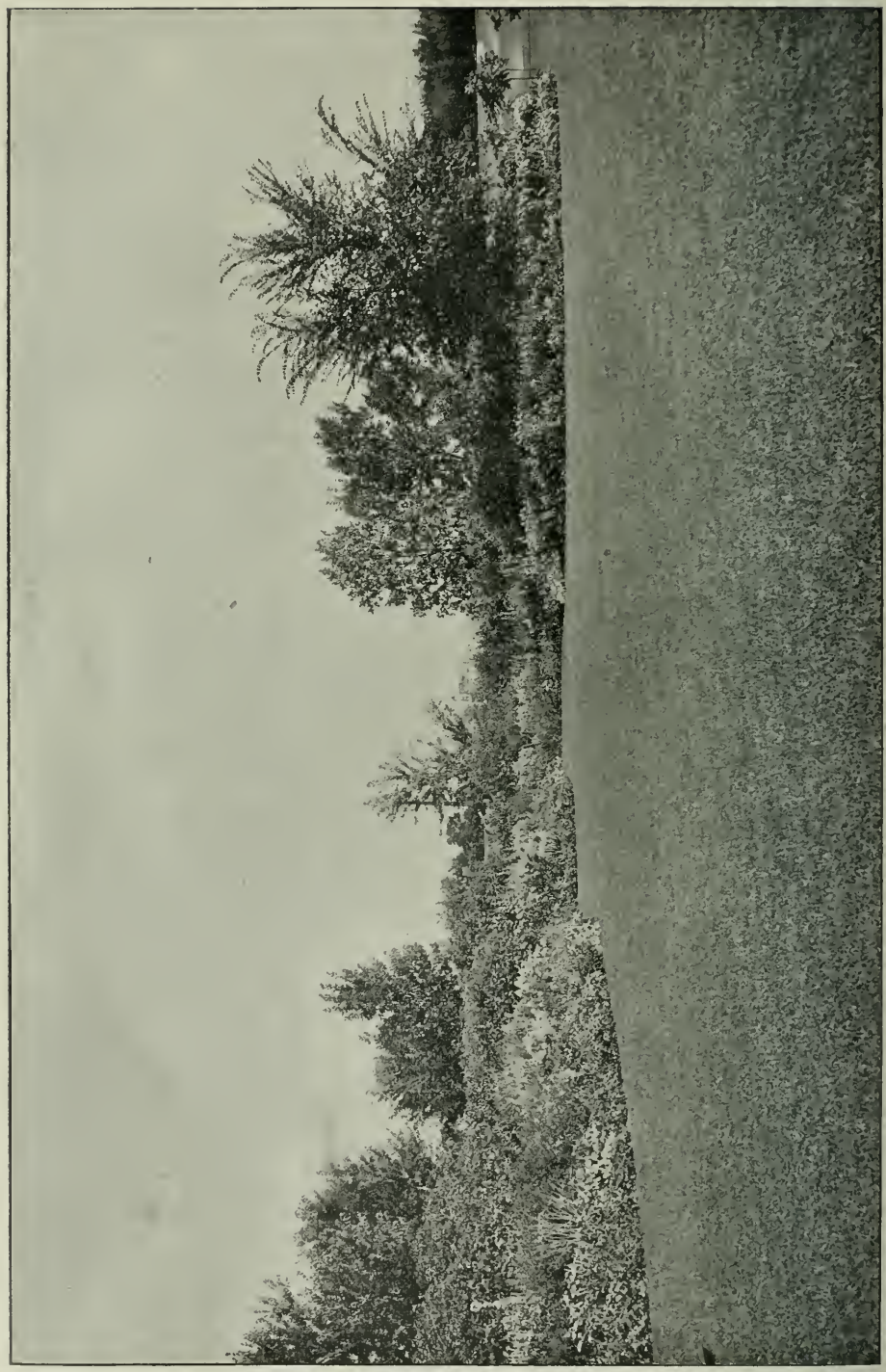
In Germany only taxpayers vote at city elections, and they are divided into three classes. The richer members, who pay one-third of the taxes, choose one-third of the town council; a second class, who pay another one-third of the taxes, select another one-third, while the great masses of the people, who pay small taxes, select the remaining one-third of the council.

In our country we do not believe in class rule. We must, and will, solve all municipal problems with universal suffrage.

Municipal taxation varies in different countries, and in various cities of the came country. Notwithstanding the fact that wages are much lower, taxes are higher in European than American cities. The principal source of revenue is from an income tax, which varies from 2 to 12 per cent. The larger the income the higher the tax.

In England the principal source of city revenue is the rates, or a tax, based on the rental value of property, or rents received. It varies from 10 to 50 per cent. and I think would average 30 per cent. of the rents receivable from all property. If the property is vacant no rates or taxes are paid. This tax is generally paid by the tenant. If land is vacant it is taxed at what it would bring for pasture. In walking across the Commons, or the vacant land near the Crystal Palace in London suburbs. I asked what that land would sell for, and was informed at about $2500 per acre. I then asked about the tax, and was told that it would be about $1.50 per acre.

The day is not far distant when the owners of vacant land in England will pay their proportion of land taxes. In London about 60 per cent. of the city's



FLOWER BED IN WASHINGTON PARK, DENVER, COLO.

revenue comes from the rates, about 10 per cent, from imperial taxes to assist the fire and police departments and the balance from licenses, fees and municipal undertakings.

In Germany the income tax is divided between the general government and the cities. The amount varies in different cities. France has no income tax. Speaking generally, I found many interesting forms of taxation. Windows and doors are taxed. A private carriage entrance from the street pays a large tax. One servant is taxed, say at $7 per annum, but for servants in livery double the amount is charged. There is an occupation tax, which includes all the activities of both men and women, except daily labor.

Business men not only pay an income tax, but also a tax on the amount of business they do. Horses, wagons, automobiles are all taxed, and generally at twice the amount if they are for pleasure instead of business. Every sale or transfer of real estate is taxed at about 2 per cent of its value.

Licenses are required for almost every line of business. In some places a music tax is collected, while in others 10 per cent. is taken by the city on all theater tickets sold. One of the worst forms of taxation found was the tax (octroi) on all food products entering cities like Paris and Vienna. It is wrong in principle, because it places the burden of taxation upon the poor. It adds about 10 per cent. to the cost of living, and is the largest source of revenue in certain cities for city purposes. It is expensive to collect, because it requires an army of inspectors. It is very unpopular with the masses, but the cities must provide some other form of taxation before they can abandon it.

The real power of city government rests in their city council, which consists of from fifty to two hundred members, elected from various districts of the city. These members serve without pay so far as dollars and cents are concerned, but they are paid with what money cannot buy, the honor and respect of the people. They are selected as a mark of honor, and no citizen will refuse to accept when called. The council elects the Mayor. In England they usually elect one of their members for a one-year term. He has no real power, but represents the dignity and the honor of the government.

In Paris the President of the council is Mayor, although there are about twenty districts in the city, each of which has a Mayor, with no important duties to perform that I was able to find, other than to keep a record of the births and deaths.

In Germany the condition is different. The council elects a Mayor, who is the real executive officer of the city, and who is paid a liberal salary. He is a man who has made municipal government a study—perhaps has devoted years in preparation. There is a school for such purposes in Berlin. He enters the work very much like a preacher does in this country, takes a small city at first. If he makes a success he is called to a large and then to a still larger city. It is not unusual for a German city to advertise for a Mayor, and send committees to other cities, and offer increased salaries to have Mayors change locations.

In some cities the mayor is elected for twelve years, with a pension for life. Others give a three years' trial, if satisfactory, then elect for life. They can retire a Mayor from active duty at any time on full pay.

The Burgomaster of Nuremberg told me that when he was called to that city about six years ago, he refused to come on a three years' trial until the city gave him a contract that if he were not wanted more than three years, Nuremberg would pay him the same pension for life that he was entitled to from the city he was leaving. This was done and when the three years was up he was re-elected for life.

The Mayor selects the heads of the various departments on account of their special fitness. He cannot make a success for himself without good assistants. Very often he calls them from other cities. He reports to the city council much in the same way that the manager of a railroad reports to his board of directors. Little or no politics exist or can be traced to the administration side of their cities.

They own and operate most of their public utilities, and while in some cases the service is not equal to that in this country, yet taken as a whole and from a city's standpoint they are better than ours. In almost every case they are operated to produce a good revenue to the city. A German expert on city government said that while he had not been to the United States, he had studied our conditions from his viewpoint, and could not understand why we operated every city enterprise which lost money, such as schools, libraries, sewers, etc., and let private companies operate every public utility which pays, to which I replied that as soon as our cities provided for their permanent management, outside of politics, more would be owned and operated here.

In fact, the most important thing needed in the government of American cities is the removal of party politics. We are getting nearer to that point of view every year. We should only nominate men in whom we have confidence, and then pledge them to an administra-

SCHOENBRUNN GARDENS AND PALACE, VIENNA, AUSTRIA-HUNGARY

could tell to what political party they belonged.

The public utilities of American cities deserve fair treatment, which many people fighting them are not willing to grant, but the day is not far distant when they will be regulated by the municipality as to service, rates and expenditures, always allowing a fair rate on the investment. If that is not permitted by the companies, then they will be owned and operated by the municipalities. Every time a corporation attempts to control, or unduly influence, a municipal official, it is hastening the day of municipal ownership in America.

When the price of bread is too high in an European city, the municipality starts a bakery, not for the purpose of putting others out of business, but for the purpose of regulating the price. In one city there were two private light companies; competition kept down the prices and the city did not want to go into the business, but when the companies formed a combination and prices went up, the city requested lower rates, which were not granted; then the Burgomaster quickly went into the open market and bought a majority of the stock of one company, took over its management and thus promptly protected his citizens by lowering the prices to a fair figure.

Some cities own and operate breweries, to insure the quality of the beer and to fix its price. Some conduct savings banks and mortgage banks; others deal in real estate, investing millions of dollars in property to be sold again, the profits going to the city. Others own and operate ship canals and docks, which have cost them vast sums of money.

In Dresden one daily newspaper is owned and operated by the city; it turns in a profit of about $100,000 per annum. The rents collected from property owned in some cities amounts to $250,000. A few cities do their own fire insurance, Hamburg being the best example, where a department of the city conducts the business at very little extra expense. They insure all property, whether you want it insured or not, and the premium is included with the regular taxes. They have a large reserve fund and feel confident they are amply protected. Their rates are not over one-half of what we pay.

To do all these things requires money, and where do they get it? First, their taxes are higher; and, second, they are great borrowers. They have no debt limit and believe that a city can do the same as the individual, borrow all it needs, so long as its credit is good. The debts carried by European cities are enormous.

Most foreign cities are conducted on the principle that individual rights must give way to the general good. They fix the building lines, and limit the height of buildings to the width of the street upon which the property faces. When new territory is to be platted the city does the platting and not the owners. They lay out not only streets and alleys, but parks and playgrounds, and are compelled by law to give the owners in lots at least two-thirds of the lands which they put into the district.

In giving these details of municipal government in Europe I do not want to be understood as saying that they all could or should be adopted in our country. The people and conditions are different, but I do want to say that we can learn much from European cities. They have worked out the details of the government. They hold up a new plan of based upon the general principle that cities must be governed for the good and happiness of the masses. City government must be worked out on the same principle in our country.

We have some people who are always wanting to change the form of city government. hTey hold up a new plan of government as the panacea for all our ills. The kind of government is much more important than the form of government. I do not believe in the commission form of government for Denver. In my opinion it would be a backward step. We have tried it here to my knowledge for over thirty years, in our Board of County Commissioners, which is the commission form of government, pure and simple. Five commissioners, elected from the county at large, to conduct its business, one to look after its finances; another its hospitals; poor; roads; bridges, etc.

In some cities this form has been an improvement over bad charters—divided responsibility, where no one could be held accountable for official acts.

If its purpose is to concentrate power, we have gone beyond it in our city by concentrating the executive power in one man—the Mayor. The power might be dangerous if there were not some way to get rid of a bad Mayor, but you have the recall, which a very small per cent. of voters can put into effect. (In my judgment the per cent. of voters is too small). Those who favor the commission form of government are always pointing to what has been accomplished in European cities, yet they fail to tell you that there is not a city in Europe governed by anything like the commission form; the size of their councils, where the real power is located, is being increased rather than decreased.

I asked an expert in Germany about the commission form of government, and he said that they would not for a moment consider any plan of government which permitted the same men to levy

PALM GARDEN BUILDING, FRANKFORT-ON-THE MAIN, GERMANY.

and to expend taxes. Their city councils make the tax levy, collect the money; while the executive departments spend it, and are held responsible for their acts; which is practically the same form as we have in Denver, except that the Mayor has a veto on the tax levy ordinance, as upon all others.

Even Mr. Lincoln Steffens, one of our greatest critics on the government of American cities, said to me that if he lived in Denver he would not favor the commission form of government, that he was not enthusiastic for it anywhere, but that he did favor some things attached to it. He believed that Denver had a charter which made it one of the most desirable cities in the United States to try out, and to solve the problem of municipal government. He said, "Some American city is going to do it, why not Denver?" The city which tries it will have his help, and the help of all writers and students who want the American city to excel in city government, as they do in so many other things. He said, "It will require an effort, which must be backed by the business men of your city." Denver's natural beauty, with the ornamentations which men have added, together with the fact that Denver was the first American city to solve the social problems of municipal life, would make her known everywhere.

If Denver were a German city, operating under German laws, there are a few things which would be promptly done. A new Union depot would be built, or the present one modernized without delay. All railways would park their right-of-way within the city limits. Wynkoop street in front of the depot would be paved; the unnecessary tracks removed, and the switching of cars allowed only during certain hours at night.

There would be no delay in the purchase of a large mountain park, and a ribbon strip would be annexed to Denver, connecting the city with the park, upon which a shaded drive and electric road would be constructed. Platte River would be walled and a drive built along each bank. The Denver Union Water Company would be purchased at the appraised vaulation, and the first step be taken towards municipal ownership. If Denver were a German city our building line ordinance would be sustained. No court would give a decision authorizing the erection of bill boards where they mar the beauty, and lessen the value of entire neighborhoods.

To my mind German cities lead in muicipal government, because:

They honor their officials and in return receive honest service. The permanent tenure of office secures trained and efficient executive officers.

They have strict libel laws, with swift execution, which do not permit newspapers to make false statements about public officials, business men or private citizens. Newspapers there, must know what they say about people to be true, or pay the penalty. Who can estimate the value that a German libel law would be to Denver?

German cities have largely taken corporation influence out of politics, by owning and operating the public utilities.

They have more power to do things—to experiment and work out a city civilization of their own—which has led to a rivalry among mayors, as well as among cities.

Let us all work together, not only for the most beautiful, but for the best governed city.

A Theoretical Formula for the Curve Resistance to the Flow of Liquids.

By Philip J, Markmann, C. E., St. Louis, Mo.

II. The Derivation of the Formula.

LET it now be proposed to build an open channel having a uniform cross-section and its bounding surface being of uniform roughness.

The alignment of the channel is a combination of tangents and curves. A certain quantity per second is to flow through this channel at a uniform velocity; therefore, the cross-section of flow (and with it, its hydraulic radius) is uniform and constant throughout.

And, necessarily under these conditions, the slope of the bed is parallel to the slope of the surface, but both are variable.

Let us further assume that we have, in some way, found a cross-section of channel, which with a certain slope in the tangents, will pass the given quantity per second, in the tangents.

If we consider by itself, the mass of the liquid, which passes a given cross-section in a second, or which is the same, the mass of a prism of the liquid v feet in length (v being the velocity per second), this prism in gliding down an inclined rough bed (of constant slope in the tangents) is moving with the uniform velocity, v, that is, there is no acceleration of motion.

MOUNTAIN ROAD NEAR THE RHONE GLAZIER, SWITZERLAND.

The hydrostatic pressures upon the two ends of the prism balance each other. Let the weight of the prism be resolved into its two components, parallel to the sloping bed and normal to same. The normal component is the normal pressure on the bed; it is balanced by the pressure of the bed upon the prism (action and reaction normal to direction of motion and having no virtual moment). The "slope" component is in the direction of the flow, and it is the "moving" force.

The friction between the moving prism and the bounding surface constitutes, in the straight course, the resistance to the motion; it is equal and opposite to the "slope" component of the weight, because the prism, moving with uniform velocity, must be under the action of balanced force in one second in overcoming the forces.

The work performed by this moving friction of v feet, is the slope component of the weight multiplied by the velocity and is equal to the resistance multiplied by the velocity.

While the velocity of the flow varies in different parts of the cross-section, being a minimum next to the bounding surface and a maximum at a point most distant from the bounding surface of the channel, the mean velocity, v, is the distance through which the slope component of the weight of the whole volume passing a cross-section in a second, moves per second.

Regarding "internal liquid friction," it may suffice to state as certain, that the particles of liquid resist being made to slide over each other, and that there is a lateral communication of motion amongst them; that is, there is a tendency of particles which move side by side to assume the same velocity.

The effects of internal friction may be stated thus: Internal friction causes a friction of a stream against its channel to take effect, not merely in retarding the film of liquid which is immediately in contact with the bounding sides of the channel, but in retarding the whole stream.

Regarding any other hypotheses of "sliding friction," "curves of velocity," flow in "fillets or filaments," etc., the speaker is in full accord with the statements of Mr. Herschel in his discussion of Mr. Charles H. Tutton's paper, "A proposed solution of hydraulic problems," published in the same volume of the Transactions A. S. C. E. with the paper "Detroit Experiments," (April, 1902, Vol. XLVII).

Let us now consider the motion of this same mass through the curve.

The velocity acts in the direction of the tangent, and the mass would continue moving in the tangent but for the constraint on the part of the channel built for it. Let us for simplicity's sake, assume the curve to be a circular curve. The change of motion of a point which moves with uniform velocity in a circular path, is necessarily a uniform deviation. The force which causes this uniform deviation must be a constant deviating force; it acts upon the mass unbalanced, and will impart to it a uniform acceleration.

Centrifugal force is the force with which a revolving body acts on the body that guides it, and is equal and opposite to the deviating force with which the guiding body reacts on the revolving body.

In fact, as every force is an action between two bodies, centrifugal force and deviating force are but two different names for the same force, according as its action on the guiding or on the revolving body is under consideration at the time.

Centripetal force is the proper name for this deviating force, as expressing the opposite direction to centrifugal force.

The author proceeds to demonstrate:

1. That the acceleration of the centrifugal force is the square of the velocity divided by the radius of the curve on which the motion occurs.

2. That the distance through which an unbalanced constant force, acting in a constantly changing direction, moves in any second is one-half of the acceleration imparted by the force to the mass. In the case of the centripetal force this distance, therefore, is one-half of the square of the velocity divided by the radius of the bend.

An unbalanced constant force continuing to act in the same direction does work which is not constant for successive seconds.

Now we realize that the deviating force which co-operates in the curve with the slope component, which latter alone does the work of moving in the straight line of the course, is not an independent force. Its existence depends on a velocity and this velocity in our case is created by the force of gravity. Therefore, the work done by the deviating force is simply a certain part of the total work performed by the force of gravity.

One part of the work of the force of gravity has been shown to be the work required to overcome the frictional resistance; the other part of the work of the force of gravity is converted into the work of deviating force, which latter is the work required to deviate the motion, hence the sum of the two is the total work which must be performed by the force of gravity. This sum represents the total expenditure of potential energy in the curve in one second.

The slope required to furnish all the energy for overcoming the frictional re-

SZABADSAG PALACE AND PLAZA, BUDAPEST, AUSTRIA-HUNGARY.

sistance and for deviating the motion is equal to the slope in the straight course plus the slope compensation for the curve resistance. This additional or curve-compensating slope is the dynamic head required for the curve resistance. It varies as the cube of the velocity v, and inversely as the square of the radius of the curve, being equal to the cube of the velocity divided by 2g times the square of the radius of the curve.

Upon further reasoning it becomes evident that this curvature head applies generally to the motion of any mass, liquid or solid, gliding or rolling down an inclined path with a uniform velocity, gravity being the moving force.

In railroad engineering, according to a definition by Willard Beahan in his "Field Practice of Railway Locations," "equating for curvature" is the "making of an allowance for the frictional resistance on curves due to the rubbing of wheel flanges on the rails, and the slipping of the wheels." As a matter of fact, this allowance, ascertained from tests, also includes the resistance of the train weight to having its motion deflected from the straight line. Of the total curve resistance to a train the additional incidental frictional resistance is the predominant part, the curve resistance proper is negligible in this case.

For a train moving at the rate of:

Mi. Per Hour.	Deg. Curve.	Lbs. Per Ton.
12	1	.005
22	1	.03
12	5	.125
22	5	.75

while it has become customary to allow 0.5 lbs. per ton for total curve resistance in a 1 degree curve.

In the case of a liquid in motion through a channel the resistance due to curvature is the resistance of the liquid to having its motion deflected from the straight line, and nothing more, as the frictional resistance in the curve is no greater than in the straight channel, if the roughness of the bounding surface is the same in both cases (which we have assumed).

Experiments, as already stated, are accepted as showing that the skin friction is independent of the pressure of the liquid on the conduit. The resistance to the flow under pressure, therefore, is just the same as that to the open flow in a pipe just full. It is, therefore, evident that the dynamic head absorbed in bends in the case of closed pipes (pipes flowing full, under head) is the same curvature head as derived in the above, and when added to that absorbed by skin friction per foot gives the total loss of head in bend per one foot.

The author has computed the accompanying table of values for the compensating slopes for velocities varying from 2½ feet to 30 feet (per second) and for radii varying from 5 feet to 1,000 feet.

These slopes added to the slope in the tangents give the total slope in the curves.

Respectively, heads added to skin friction head give the total head lost in the bend.

NUMERICAL EXAMPLES FOR CURVE COMPENSATION.

A 42-inch diameter brick sewer, with a slope S, equals .005 (in the tangents), with Kutter's co-efficient c (n equals .013), in the Chezy formula has a capacity of about 72 sec. cu. ft. and a mean velocity of flow equals about 7½ ft. per sec.

500 ft.	.000026	.005	.005026
200 ft.	.000164	.005	.005164
150 ft.	.00029	.005	.00529
100 ft.	.000656	.005	.005656
50 ft.	.0026	.005	.0076
25 ft.	.0104	.005	.0154
15 ft.	.029	.005	.034

A 10-ft. diameter brick sewer with a slope s=.0025 (in the tangent) with Kutter's coefficient c (n=.013) in the Chezy formula has a capacity of about 780 sec. cu. ft., and a mean velocity of flow equal to about 10 feet per sec.

500 ft.	.000062	.0025	.002562
200 ft.	.00039	.0025	.00289
100 ft.	.00155	.0025	.00405
50 ft.	.00620	.0025	.00870

The loss of head for the entire curve is the above curve-compensating slope multiplied by the length of the curve, or, in the form of an equation,

$$H_2 = \frac{l_c\, v^3}{2\, g\, r^2}$$

Since the radius of the curve appears in the value of l, this equation says that the curvature-head for the entire length of the curve is inversely as the radius of the curve i. e. if we double the radius of the curve, i. e., if we double the radius of length of the curve), we reduce the curvature-head for the entire length of the new curve to one-half of the curvature-head of the previous curve (of one-half the length), and if we treble the radius of the curve we reduce the curvature-head to one-third of the original curvature-head.

This fact should be remembered in considering the experimental work and the conclusions of Williams, Hubbell and Fenkell, the Detroit engineers.

THE APOLLO BASIN AND ESPLANADE, VERSAILLES, NEAR PARIS, FRANCE.

CURVATURE HEAD IN FEET, FOR ONE FOOT LENGTH OF CURVE.

For radii from 5 feet to 1000 feet, and velocities from 2½ feet to 30 feet per second.

Radius in feet.	Velocities in feet per second. 2.5	5	7.5	10	15	20	25	30
5	.009705	.077640	.262040	.621100	2.101000	4.969000	9.705000	16.770000
15	.001068	.008627	.029116	.069011	.233444	.552111	1.068333	1.964444
25	.000380	.003040	.010400	.024800	.083950	.199008	.388672	.671632
50	.000097	.000777	.002600	.006200	.020988	.049600	.097168	.167408
75	.000043	.000340	.001166	.002750	.009328	.022112	.043186	.074626
100	.000024	.000194	.000656	.001555	.005247	.012438	.024292	.041977
150	.000011	.000086	.000290	.000690	.002332	.005528	.010796	.018656
200	.000006	.000049	.000164	.000390	.001312	.003109	.006068	.010494
300	.000003	.000022	.000070	.000170	.000583	.001382	.002699	.004664
500	.000001	.000007	.000026	.000062	.000210	.000496	.000972	.001679
1000	.000000	.000002	.000006	.000015	.000053	.000124	.000242	.000420

The above quantities, added to s (the slope in the tangent), gives the total slope in the curve, or added to h (loss of head in straight pipe), gives total (net) loss of head in bend.

Notes and Queries on Grouted and Sand-Filled Brick Pavements.*

By Maury Nicholson, City Engineer, Birmingham, Ala.

THE following notes are gathered from the writer's personal experiences and observations of brick pavements during the past ten years. They relate especially to two grout-filled pavements without expansion joints of any kind; one grout-filled pavement that is provided with expansion joints, and two sand-filled pavements. They are selected as illustrating the different results obtained. If a discussion of these notes shall prove to be an "ounce of prevention" or a "pound of cure" for any of the troubles of brick pavements, then they will not have been written in vain.

In 1901 the writer had charge of the construction of seven blocks of brick paving on Twenty-first street, from First to Eighth avenue, in Birmingham, Ala. The street has a roadway 50 to 56 feet wide between curbs. From First to Second avenue there is a single line of street car track; from Second to Sixth avenue there is a double track, and from Sixth to Eighth avenue there are no tracks. The tracks are laid with seven-inch grooved girder rails and were in constant use during construction of the pavement. Tie bars were designed for the tracks, but they were abandoned because they interfered so seriously with the laying of the brick between the rails; and it was thought that the pavement would support the rails against spreading. Experience has proved this to be true, as no trouble from spreading has occurred.

The pavement is laid on a five-inch concrete base with a two-inch sand cushion, and is grouted with Portland cement grout composed of one part cement and two parts fine sand. No expansion joints of any kind were provided. The pavement was laid between November, 1901, and April, 1902. This was one of the first grouted brick pavements laid in Birmingham, and great care was taken with the grouting; and a most excellent job was secured, every joint being filled flush with the surface and kept full until set, with grout of uniform proportions that gripped the brick literally into a solid monolithic mass, so perfect that it proved to be the cause of serious trouble from expansion.

The grouting was done by mixing in a mortar box and flushing it onto the brick from a gate in one end of the box, especial care being taken to keep the mixture agitated constantly while in the box, and in rapid motion while on the surface of the pavement.

In the summer following the completion of the work the roaring under traffic, due to lifting of the brick from the sand cushion by expansion, became so great in certain parts of the pavement that immediate relief was necessary, and it was decided to cut out a row of brick across the roadway at a summit in the grade, and another at a point about a block from this, where the noise was greatest. This was done by cutting from both gutters at the same time towards the center, and when only about twenty-four inches of brick were left uncut the pressure was so great that chips began flying from it, and it was completely crushed. The spaces where these rows of brick were cut out closed up 1¼ inches. This greatly relieved the roaring at the time, but did not completely overcome it.

In another place, two blocks from this, a channel was cut through the brick along the outer rails of the street car tracks, but this proved to have very little effect in stopping the noise; and outside the

*Paper before the American Society of Municipal Improvements

car tracks the brick was later replaced with a bituminous pavement in this block.

The end block of this pavement is isolated from the others by sand-filled granite block intersections at each end, which act as expansion joints, and have prevented any serious roaring.

In this block there are numerous fine cracks extending along the joints between the rows of bricks, which are probably due to two causes: First, shearing between the rows caused by deflection under expansion pressure; since the rows are not free to move along the curb on account of its rough surface they become beams with fixed ends, which are deflected at their center in the direction of the expansion, thus causing a sliding or shearing between the rows. Second, pulling apart under tension strains, caused by contraction. These cracks are all small and have not materially affected the wear of the pavement. They cannot be seen when the pavement is dry, but are visible when it begins to dry off after being flushed.

In and near the intersection of Sixth avenue (Seventh avenue and Park avenue) there are large cracks extending along the general direction of the street and across the rows of bricks.

The size and position of these cracks suggest that they are probably due to one or both of two causes: First, the longitudinal expansion thrust is resisted by the fixed wings of the pavement extending to the property lines at intersecting streets, thus causing a shearing or buckling of the pavement along the general direction of the street. Second, the center of the intersection being less protected by trees and buildings from the direct rays of the sun becomes heated much more rapidly and to a higher degree than the adjoining parts of the pavement, buckles or raises up in a blister and cracks along lines of least resistance, which lines are shown in the herringbone bond to be entirely along the joints, not a brick being broken the whole length of the cracks in this bond, while in the straight bond work this is not the case, as the cracks are across the brick as often as along the joints.

In none of the blocks where there are car tracks are there any cracks extending in the general direction of the street and across the rows of bricks, but all of them show the small transverse cracks between the rows of bricks.

There are no longitudinal cracks either between the rails of the tracks or between the tracks, and there has been no preceptible lifting of the pavement in these spaces. Why is this? What has become of the expansion in the spaces?

Speaking generally, many of the apparently contradictory or unexpected troubles in grouted brick pavements, the writer believes, are due to the unequal heating of different parts of the pavement. The more exposed parts, as the center of the roadway in the blocks and the intersections, may, owing to local conditions of position and height of trees and buildings along the streets, the direction of the street with reference to the path of the sun, and the relative cleanliness of the surface of the pavement in the center and at the sides, become heated so much more rapidly and to such greater degree than the less exposed portions, as to cause it to expand and crush, or more often to buckle up like a blister and break in cracks along the heated portion.

Using the same specifications, the same methods of construction and the same brick, ten blocks on Eleventh avenue, south, were paved between April and November, 1901. This avenue runs at right angles to the direction of Twenty-first street, which runs north 35 degrees west. The roadway is 30 feet and 42 feet wide, with a double street car track line on the wider, and a single track on the narrower portions. The avenue is in a valuable residence section and is planted with trees along the parking on both sides for its entire length. Along the narrower roadway the foliage now almost meets over the center, and extends well out over it along the wider roadway. In this pavement, as in Twenty-first street, no expansion joints of any kind were provided. The track construction is "T" rail with nose brick. The grouting of this work was only a little less thorough than that of Twenty-first street, and portions that have not been distributed by cuts show a smoothly worn, unbroken surface. Although the same materials and methods of construction were used in this as in the Twenty-first street pavement, in this one there has never been any roaring nor any shearing or buckling cracks in any part of it, the only cracks being the small transverse ones between the rows of bricks, which are less decided in appearance and somewhat fewer in number. There are a number of crushed spots in this pavement, varying in size from two or three square feet to as many square yards. The cause of these is not apparent, and the writer can offer no satisfactory explanation to account for them. Will some brick expert please explain these and similar conditions on Twenty-first street, giving reasons why one pavement roared under traffic, buckled and cracked badly, and the other did not; and discuss the writer's suggested explanations of the cause of these troubles?

In Cleveland, Ohio, in the fall of 1909, the writer inspected many cement grout-filled brick pavements and noted some facts that have never been understood, the most remarkable one being a crack

in the pavement between the rails of a street car track. This crack was approximately in the center, between the rails, was absolutely straight and extended the whole length of one or more blocks. It was so straight and long, and so nearly parallel to the rails that it appeared to have been made in the pavement as an expansion joint, but such was not the case, as it appeared some time after completion of the work. The writer's recollection is that there were several instances of this in different streets inspected. What is the explanation of this?

A second note is to the effect that in many of the brick highways leading from Cleveland into the country, some of which are eight or ten miles long, no expansion joints were provided, and there seems to have been no roaring or buckling of these pavements, and only a few instances of cracks, which occurred where the roadbed was in thorough cut. What has become of the longitudinal expansion in these cases? The writer believes that the normal temperature at which pavements are laid is an important factor to be taken into consideration in providing for expansion, and a knowledge of what this temperature was when any particular pavement was laid will often account in a large measure for the presence or absence of expansion troubles.

A grouted brick pavement along the railroad tracks on Seventeenth street, between Fourth and Fifth avenues, at Birmingham, Ala., was provided with one-half inch transverse expansion joints every 75 feet. The track construction is "T" rail and special nose brick extend under the ball of the rail to form the flange groove. Here the brick have raised up in one car track until they are as much as 2½ inches above the rail, the nose of the special-shaped brick forming the flange groove having been sheared off along the flange groove; and this occurred at an expansion joint that is supposed to prevent this very trouble.

An examination of two of these expansion joints, made when the pavement was being repaired, showed that they were not acting as expansion joints, because in one case the bottom third of the joint was filled with grout, the middle third with sand, and the top third with pitch; and in the other case the bottom two-thirds were filled with sand, and the top third with pitch. These joints were made in the following manner: After the brick were laid, and before being rolled or grouted, at intervals of 75 feet two rows of brick were spread apart one-half inch and the joint filled with sand, then the rolling and grouting was done and the joint was supposed to be cleaned out to the bottom of the brick and filled with pitch. In this case the sand was not removed more than one-third the depth of the joint, and the joint had been closed to one-quarter inch by the rolling of the brick; also the filling of the joint with sand was probably not perfect, so that grout leaked into the vacant spaces from the adjoining rows of brick, and formed with the sand which was not removed, a rigid instead of an expansion joint.

These results emphasize the necessity of having the joints completely filled sand from bottom to top, which is best done by tamping in moist sand, and after grouting seeing that it is all removed to the bottom of the brick before the filler is added. Some engineers advocate the practice of filling five or six successive transverse joints, at intervals of 50 feet, with the expansion filler after rolling, and just before grouting the brick. The objection to this is the increased number of lines of weakness in the surface of the pavement, which under heavy traffic will wear badly. When traffic is light this objection has less weight. If the single joint is used it should be made by spreading the brick after rolling and just before grouting, and should be filled with the expansion material as soon as made.

The writer believes that one-half inch joints at 50-foot intervals, if properly made, will give best results. The most frequently specified method of forming the joint, by placing a wooden strip one-half inch by four inches at specified intervals when the brick are being laid, and removing it after grouting is done, and then filling the joint, has the serious objection that unless the top edge of the strip is below the surface of the brick it is not possible to properly roll the surface, and if it is kept below, it is very difficult to remove after grouting; and unless removed before the grout has set hard it is often impossible to remove it, and removing it before the grout is hard set often results in breaking the bond of the grout in several adjacent joints. The writer would like to know if any one has tried leaving one-half inch soft wood strips in the pavement as expansive joints.

The writer's observation is that more failures in grouting are due to lack of the use of a sufficient amount of water in making and applying the grout than to any other cause.

When properly made and applied, grout will completely fill all joints that are as much as one-sixteenth of an inch in width, and joints wider than one-eighth of an inch are unnecessary.

It is important that the joints between the ends of the bricks should be open at least the minimum width, but no provision is made for this usually, and as a result many of them are so small that they are not filled with grout, which

causes the chipping of the brick along the ends.

The writer would like to hear opinions based on experience as to the relative merits of the large paving block, 3x4x8¼ or larger, as they are now made, compared with the smaller brick, 2⅝x4x8, or less, as they were made several years ago, his own experience being that the smaller brick, both in sand-filled and grouted pavements, have given very much better results than the larger block made from the same material.

On South Twentieth street, from Avenue H to Avenue O, a sand-filled pavement was completed in September, 1900. This has a 30-foot roadway with single track street car line on it. "T" rail and nose track brick construction was used. The surface of this pavement is in better condition than that of Second avenue, due to the much lighter traffic over it. In this case the special brick forming the flange grooves have not been worn by traffic as on Second avenue, and where the foundation of the track has remained rigid the groove is in good condition, but at all places where the track has gone down and started vertical motion in the rails these brick have worked up and out of the pavement, and proved very troublesome to keep in place. Much of this trouble would have been prevented if the ends of the nose brick had been placed just clear of the gauge line, and the space between their ends and the web of the rail filled with a lean mortar or some other filler.

Highly satisfactory results can be obtained from any sand-filled pavement properly laid with first-class brick which are uniform in size and true in shape, and such a pavement will serve every purpose of a medium or light traffic street, with the advantage of less first cost, greater ease of repair, freedom from roaring or cracking, avoiding of delays to traffic during construction necessitated by keeping the street closed to allow the grout proper time to set and harden, and better foothold for animals on steep grades.

Widely different results in a sand-filled pavement completed in January, 1908, forcibly illustrate the necessity for first-class brick uniform in size and true in shape. his pavement has been subject to practically the same traffic conditions as that on South Fourteenth street.

Contraction and Expansion of Brick Pavements.*

By Will P. Blair, National Paving Brick Manufacturers' Association, Cleveland, O.

THE extent of injury done to brick street pavements from contraction and expansion has been greatly magnified on the one hand, and the difficulties in preventing any injury at all has been enlarged upon to an exasperating degree. We freely grant that there are behaviors in structural materials, particularly of cement, brick and iron, that are not fully and completely understood, in spite of the research work that has been done by various investigators. But that is no argument at all against the use, within the range of what we do know and even beyond that which we know, even if we should encounter hazardous and strange phenomena. In fact, if we are to await a perfect knowledge and information concerning all utilitarian matters but little progress would be made and we would be without the enjoyment of many useful and pleasurable things in life.

The city of Cleveland has afforded a field of study during the past season much beyond that of any locality in the country. The season has been very changeable in temperature. Sometimes a variation has occurred of more than 40 degrees within a period of one week, but in the experience of many years preceding the temperature has not been subject to such great variations. While it is entirely fair to say that 75 per cent. of the streets of Cleveland are properly cement filled, provision for expansion and contraction has not been considered of very great importance, and to a very large extent has been neglected. Even with the streets built under contracts calling for expansion cushions, very few streets are found where the provision exists. In spite, however, of the almost entire lack of provision for expansion and contraction, out of more than 2,700 street intersections, but 27 ruptures occurred. Twelve of these were examined personally by the writer, and in every case no provision for expansion relief whatever was found. In the remaining, I was assured by Mr. Abbott, the engineer in charge of repairs in that city, the same lack was in evidence. Throughout the city quite a few cracks occurred away from intersections, but these are not really serious to the utility of the pavement because it very seldom occurs that rutting follows; at the worst, no greater injury follows than that which occurs to

*Paper before the American Society of Municipal Improvements.

each individual brick where soft fillers are used. In no case, however, have they occurred where expansion cushions have been provided.

There occurred a rupture at the intersection of Decker avenue and East Eighteenth street, neither of which had any provision at all for expansion relief along the curb or transversely. The expansion force necessarily found relief at the intersection. You may ask, why at the intersection? Simply because it was the only place that the concentration of the forces found in the four streets could occur. The force of expansion concentrated at the intersection square, in comparison with that directed against any other portion, was the greater and so the resistance was weak and could not but yield to the strain. Any other part of either street could be approached by the force of expansion concentrating from but two directions, but in the intersection the force was fourfold. The compressive resistance was no more than in a single street, so that a rupture followed. Observing gentlemen in the neighborhood informed me that it raised five feet at the intersection. A nine-yearlold boy with mental equipment for accuracy informed me the men did not know what they were talking about, but that he did, as he measured it with a rule, and the highest portion of the rupture stood just three feet and one-half above the sand cushion. It could easily be discerned that there was a slight movement in these four streets at a distance away from the intersection of more than 100 feet. Evidences were apparent that along with this movement had been an outward force pushing against the curb, increasing as it approached the place of rupture.

Another rupture, of which I was unable to secure photographs, I had an opportunity to observe while the expansive force was in operation. Evidences were easily noted 200 feet back in one direction from the intersection, in which were placed four manholes. The portion of the street approaching this intersection from the opposite direction had the advantage of a much more perfectly constructed pavement. It was built by a different contractor and under different specifications. The cement filler was in the joints, filling them completely from top to bottom. The mixture was uniform and the expansion cushion fairly adequate. This portion of the street, although subjected to the heat of the sun equal to the other portion, with the assistance of the four manholes, stood apparently immovable. It had no transverse expansion cushion, but relief from expansion was sufficient at the curb; at least with what was held in compression the brick retained perfect contact with the the sand bed.

The street opposite, approaching the intersection in which the expansion movement was particularly noticed, was not so well constructed. The cement in the interstices was irregular; the sand cushion had not been properly compressed, so that there was an uneven flow of the sand in the interstices from the original rolling of the brick; there was no compressive relief apparent in the street at all. As the intersection was approached, it was observed that the outward force of the street was much more severe near the rupture than 100 feet away from it, but the shattering and the crushing was all confined within that portion of the street improperly constructed. No part of that portion of the street properly constructed was harmed at all.

It so happened that prior to the construction of the Indianapolis Motor Speedway a temporary brick surface was put down about 16 feet in width and 200 feet long, for the purpose of merely testing a brick surface as to its adaptability as a race course, before it was finally decided to brick the entire track. This particular portion was poorly constructed, particularly in the application of the cement filler; the interstices were neither filled completely to the bottom, nor were they full and flush with the surface. And, though we warned of disaster to come and urged that it be eliminated, for the sake of economy it afterwards became a part of the track as finished. But little of this entire track was finished with the expansion cushion—simply a case of putting off until a more convenient season. Along this temporary portion no expansion provision has been made. On account of weakness of the cement filler, it was unable to sustain a uniform compressive strength with the rest of the pavement. A bulge occurred at this weak side. The superintendent of the speedway at once concluded that he ought to relieve the strain by taking out two courses of brick across the entire pavement. Proceeding from the point of the rupture in the better constructed portion of the pavement, he soon discovered that as he weakened the pavement there was a slight movement or creeping of the entire pavement. He then went to the opposite side of the track and began to take out two courses of brick at that side of the pavement, but there was a time when the equilibrium was past and the resisting force at the center of the pavement was too weak to withstand the expansion pressure and the force found sudden relief in a sudden crush, frightening the workmen so much that one declined to have anything more to do with it.

We secured photographs which show clearly two things to have occurred: The weak portion received the greatest rupture from the crushing force; the pavement sheared in the center and crept on

the sand cushion the full width of the brick more than the other portion. The other portion of the pavement, being uniform throughout in strength, did not show a rupture, but simply closed up the crevices from which had been extracted two courses and stopped. It is clearly obvious that the expansive force of this portion of the pavement had found relief in compression. Yet in this stretching out process no crack occurred, so tough and strong was the pavement in its monolithic structure.

It had been decided by the owners of the speedway to change an overhead bridge to a subway passage. This change, in the interest of economy, necessitated taking up a strip of pavement the full width of the track. The superintendent, on account of his experience as described, was a little at a loss to know how to proceed. The writer advised that, as he took out his first line across the track, he insert wooden blocks in a way to be drawn simultaneously and to do the work in the night time, taking advantage of the lowest possible temperature. This course was pursued, and an opening made, which was followed by extreme high temperature. The closure followed from either direction nearly the entire width of the brick and then the pavement, by contraction, receded one-half the width of its advance and again no crack occurred in this action of contraction and expansion.

From this observation and experience gained, we are confirmed in several matters, sustaining our No. 1 Directions. First, demonstrating conclusively the force at work, destructive of the courses of brick that are found on either side of every transverse expansion provision. It is simply jamming together—a movement of the entire street in opposite directions toward a weak portion. Many examples of this character can easily be seen in this city of Grand Rapids. It confirms us in the view that no transverse cushion should be provided. Second, it fully supports our contentions and insistence for a uniform mixture of sand and cement. It is easily discerned that much of the expansive force can be and is taken up in compression. If the pavement is uniform in strength much relief in compression is afforded and can be depended upon. Third, in every operation of compression from two opposite directions, a certain portion of relief at least is diverted to another direction. You may say that this last statement is not exactly borne out by the observations and experiences cited. But suppose it is not entirely proven and you do provide for a full and complete relief of all of the expansive forces in the other two directions by a cushion along the curb, then you have at least relieved the pavement of one-half its expansion force, and with this, together with what relief is found in compression, the pavement is relieved or held intact to such an extent that it is scarcely subject to any injury whatever from expanding and contracting forces.

To further assure us that no bad results will follow if proper provision for expansion is made along the curb, it is necessary to heed the importance of having the cement filler uniform in strength, so we insist that the sand cushion be compressed in order that there shall be no flow of sand into the joints, which should be occupied in full by the cement filler, thus affording a uniform strength throughout the monolithic structure, lessening the chances for rupture; for just to the extent that the filler lacks in strength and uniformity will a crack, rupture or destruction of the pavement follow.

To what extent cracks appear in pavements, or if at all, due to the variations that follow a wet and dry condition we are unable to say. That a certain minimum amount of contraction and expansion parallels the condition, no one can doubt; but it is believed that the strength of a monolithic structure is such that a crack occurring from such cause rarely takes place. There is no question but that cracks frequently occur due to the expansion caused by frost, or more particularly resulting from the expansive force of the frozen ground underneath the pavement. Dry earth is in no way affected by low temperature.

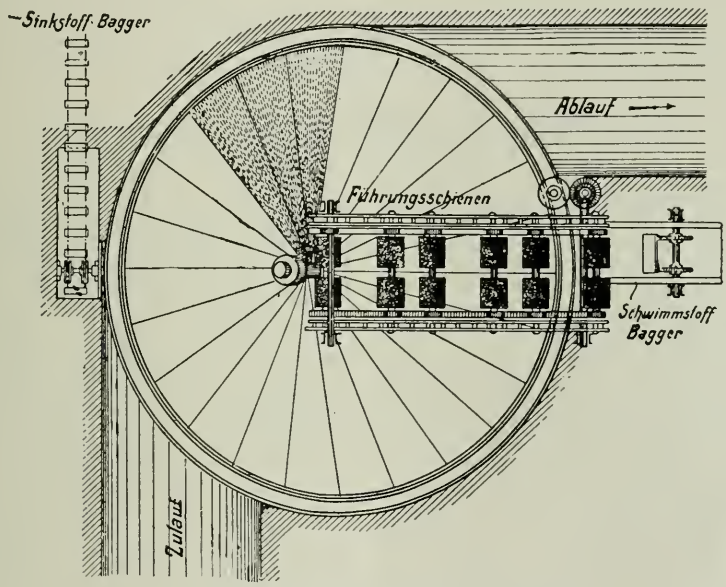
We have, then, but two elements with which to deal in preventing cracks and ruptures in cement-filled brick pavements. First, simply a provision along the curb for an expansion cushion, which is an easy matter and only requires very simple implements to make effective the necessary provision. The trouble generally has been either a determination not to make proper provision or undertaking to do it without any implements at all, merely substituting some one makeshift or another for the purpose.

As to the cracks due to low temperature, it is simply a question of drainage. The manner and method of proper drainage are controlled entirely by the character of the soil and grades. Most soils are easily drained by tiles along either side, either within or without the curb, surplus water being taken out through "T" outlets at frequent intervals. Long drains underneath the roadbed are obviously objectionable for many reasons, though they are sometimes resorted to. A better method of drainage where the soil is such that by capillary attraction the moisture climbs to the highest point, is by alternate side drains heading slightly beyond the center line.

A Rotary Sieve for Sewage.

By Robert Grinshaw, Dresden, Germany.

THE apparatus here described, and which has for its object the seperation of the purely liquid matter of sewage from the mechanically suspended portions, consists of a conical sieve rotating about an axis inclined 15 to 20 degrees from the vertical, and so built in a circular enlargement of the sewer that the conical surface is strongly inclined to the flow of the sewage; the tip of the portion uncovered by the sewage lying nearly horizontal. This arrangement permits ninety per cent. of the perforated surface to be washed by the filtered sewage; the solid material being caught on only a small section of the outer surface. By this means nearly the entire height of the cone is utilized as a filter. The materials caught are raised by the apparatus to its highest lying point and then removed automatically by a horizontal lying off-bearer.



PLAN OF REVOLVING SEWAGE SCREEN.

This latter consists of an endless chain bearing a number of rotating brushes. These run between guide-rails, which are so adjustable that the brushes act only on that portion of the perforated sheet metal composing the sieve, which is covered with non-liquid materials. This saves wear and tear of the brushes; and the fatty particles which collect on the brushes are not spread over the perforated metal.

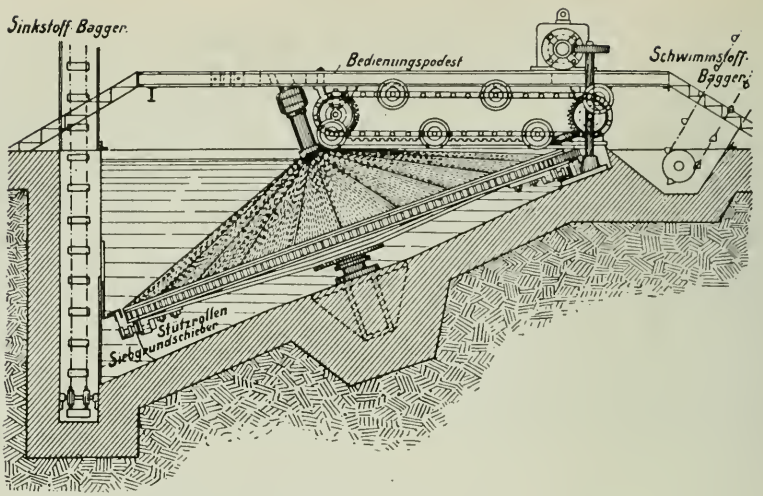
The housing of the cone is made up of separate strips attached by a hollow shaft, and at their free ends connected by a channel-iron ring. This latter serves at the same time to attach the annular gear which drives the mechanism. Each binding piece has also at its free end a bearing roller, which runs on a ring-shaped rail attached to the masonry. This serves to oppose resistance to the one-sided pressure of the sewage.

The entire housing, with the conical sieve, rotates about a stationary steel shaft; above there is a throat ball bearing, and below a bearing with anti-friction rollers. The stationary shaft is held above by the attendant's platform, and below in an adjustable bearing in the foundation.

The apparatus is driven from the attendant's platform by an electric motor; an internal combustion motor, or belt and pulley.

The orifices of the sieve form over forty per cent, of the surface of the sheet metal.

The manufacturer is the Maschinenbau & Metalltuchfabrik, Raguhn, Anhalt, Germany.



SECTION OF REVOLVING SEWAGE SCREEN.

The Ohio State Highway Organization.

Editorial Correspondence.

THE State Highway Department of Ohio has been completely reorganized in accordance with an act of the State legislature on May 31, and which became a law on June 9. This act possesses many points which make it unique and particularly effective.

The most notable feature of the provisions in this act is the tendency toward centralization of authority, and consequent directness and freedom from all forms of "red tape". The Highway Commissioner is made the real head of the organization, and authority fully adequate to the responsibilities of the office is given. He has the power to appoint his deputies, and assistants; he is given the final decision in choosing the routes of the "inter-county," or main arterial roads; the final decision as to the kinds of materials suitable for the construction of the road is left to his judgment; and under certain conditions he is given the right to expend the apportionment of a county upon such roads, within the county, as he shall determine.

The provisions for providing money for highway construction are peculiar in some respects. An appropriation by the state is provided. This appropriation is to be equally divided among the various counties. In addition to these funds the county commissioners are authorized to sell bonds to an amount not exceeding in the aggregate one per cent. of the tax duplicate of the county. In event that the state apportionment is not made use of by the county commissioners within the year in which it is available, the township trustees have the right to make application prior to April of the succeeding year. If the township authorities do not make use of the apportionment prior to July, then the highway commissioner has full power to construct, improve, maintain or repair any of the designated "inter-county" roads within the county as he may desire. When all "inter-county" roads have been constructed, the money available may be used for other roads within the county.

In order to facilitate the work of the commissioner and to assist him in the intimate study of local conditions, provision has been made to provide accurate data for his information, concerning the various counties of the state. It is provided in the act, that within sixty days after its passage, the county commissioners shall direct the county surveyor of each county to make an accurate map or maps of the county, showing all rivers, railroads, streams, township lines, cities, towns, highways, and all topographical features of value to the work. These maps are preserved in the original by the county engineer, but blue prints are forwarded to each board of township trustees. Immediately upon receipt of the blue print the township trustees are directed to denote the relative value of each road in the township in the consecutive order as used highway, the kind of traffic over each road, the number of miles length of each, the material used in the improvements of the roads, when constructed,

their present condition, and other such information as might prove of service to the commissioner. A time limit is set upon the furnishing of this information, and blanks are furnished, and provision is made for compensating the officers for the time expended in preparing all this information. The blanks and information furnished by the township authorities are forwarded to the county commissioners, and they with the county surveyor compile and tabulate the matter concerning the roads of the entire county. They in turn file their statistics and information, when prepared, with the State Highway Commissioner. In this way he has direct and accurate data regarding roads throughout the state. The highway commissioner is given power, in event of the failure of the local officers to secure the data, to have the material compiled under his direction, and to deduct the cost from any state road funds due to the county.

From the information thus gathered, the commissioner is allowed to designate the main roads of the state, to be known as "inter-county" roads. The highway improvement under the "state aid" is limited to these "inter-county" roads, and direction is authorized in the case of any expenritures for road work. The commissioner is made final arbiter in these cases.

The procedure involved in securing a state aid road is as follows:

Either the county commissioner or the township trustees may make application for the state aid under the conditions above noted. Upon receipt of the application, the highway commissioner determines upon the importance of the road petitioned for, considering its use, location, and value for common traffic. If he approves the application, he directs the preparation of plans, profiles, specifications, and estimates. He designates the kind of construction, *i.e.*, telford, macadam, brick, gravel or other material; taking into consideration the local conditions of traffic, climate, soil and other governing conditions. Upon receipt of the plans, specifications, etc., the county commissioners (or township trustees) may vote a resolution to the effect that the highway designated be constructed. The highway commissioner then advertises for bids and lets the contract, subject to the approval of the local authorities. It is definitely specified that no contract may be awarded upon a bid under force account in event that the missioner is allowed to complete the work contractor defaults on his contract.
which is greater than the estimate submitted by the state department. The com-

Payment for the state aid roads is proportioned among state, county, township or townships, and abutting property owners. Where the improvement costs an amount equal to or less than twice the amount apportioned by the state to the county, then the state pays fifty per cent. of the total expense. Where the cost exceeds this amount., the state pays only the apportioned amount. The rest of the cost is divided as follows. One-fourth of the cost is apportioned to the county and one-fourth is apportioned to the township or townships in which the road is located; three-fifths of the township apportionment being a charge upon the township treasury, and two-fifths being assessed against the abutting property, according to the benefits accruing.

Highways improved under state aid are to be maintained by the highway commissioner, the expense of such repair being divided as follows: Twenty-five per cent. payable by the state, fifty per cent. by the county, and twenty-five per cent. by the township. The state's share is provided from a general fund appropriated for the purpose. Proportions are somewhat different in special cases defined in the law.

As will be noted from the foregoing, a great deal of power is placed in the hands of the highway commissioner. He is given the final decision in all matters relating to the general state road work. He is left entirely free from petty local influences such as govern the selection of state aid roads in many states, and at the same time the local authorities are given a decision in the matter of expending their funds.

The working organization of the state department of highways is definitely provided for under the new act. The highway commissioner is the head of the organization, with a salary of $4,000 per annum. Three deputies, one in charge of construction and improvement, one as supervisor of all material pertaining to maintenance and repair, and the third having supervision of the design, construction, maintenance and repair of culverts and bridges, are appointed by the commissioner. These deputies each receive a salary of $3,000 per annum. The state highway commissioner may also appoint the following division engineers: Not more than four in the bureau of construction, not to exceed two in the bureau of maintenance, and not to exceed two in the bureau of bridges. Additional clerks and office force are also provided for.

At the present time the Ohio road department is distinctively a young man's organization, most of them being graduates from Ohio State University. It includes James R. Marker, commissioner; Clifford Shoemaker, Clyde T. Morris and A. H. Hinkle, deputy commissioners, the two latter taken from the faculty of the university.

An Automatic Pneumatic Pumping Plant at Shirley, Ind.

SHIRLEY, Indiana, a town of 1000 inhabitants 30 miles east of Indianapolis, Ind., upon the Peoria-Springfield branch of the Big Four railroad, had been visited by several comparatively disastrous fires until the question of a water works plant was taken up and Mr. Geo. C. Wallace of Anderson, Ind., employed as consulting engineer. Specifications were drawn up and bids advertised for, the supply being an abandoned gas well 8 inches in diameter that was plugged above the salt water.

About two years ago, the job was let as follows: Power house and well equipment to Harris Air Pump Co. of Indianapolis, Ind.; tank and tower to Des Moines Bridge & Iron Works of Des Moines, Iowa; cast iron pipe, hydrants, valves, etc., bought and erected by the town direct.

The tank and tower were of standard construction, about 100 feet high and placed over the well and along side of the city hall, having capacity of about 39,000 gallons. A small room added to this building 30x15 ft. was all the space required by the power equipment.

Conditions of operation:

Gallons pumped per minute.....200
Lift in well to surface..... 60 feet
Submergence of air lift pump.... 90 feet
Depth of pump in well.....150 feet
Total head of water above ground 100 feet
Working air pressure ..... 45 lbs.
Cu. ft. free air required per minute 198
Developed horse power..... 25

Air Compressor—One Ingersoll-Rand straight line belt driven air compressor of their NE-1 type, having double acting air cylinder 10-in. diameter by 12-inch stroke, which at 180 revolutions per minute has a piston displacement of 233 cu. ft. free air per minute. This compressor was fitted with automatic sight feed lubricator for air cylinder. All of the bearings are lubricated by means of enclosed splash lubrication.

Air Receiver—One vertical steel air receiver 36-in. diameter by 6 ft. high, fitted with manhole, safety valve, pressure gauge and drain cock.

Motor—One General Electric 25 horse power motor with automatic switch and pressure regulator.

Belt—One 10-in. two-ply leather belt of sufficient length for 16 ft. centers between motor pulley and compressor belt wheel.

Air Lift—One No. 8 Harris Air Pump Company's 20th Century air lift pump, having 4-in. discharge and 4½-in. inlet. This pump being made of bronze with the air line carried down outside of the water discharge and brought up to center of pump and discharged through a special tube or mixer carries the weight of the water column upon the air jet; thus combining the initial discharge with the air expansion and obviating the slippage obtaining in the usual air lift, there being no valves or moving parts in this pump.

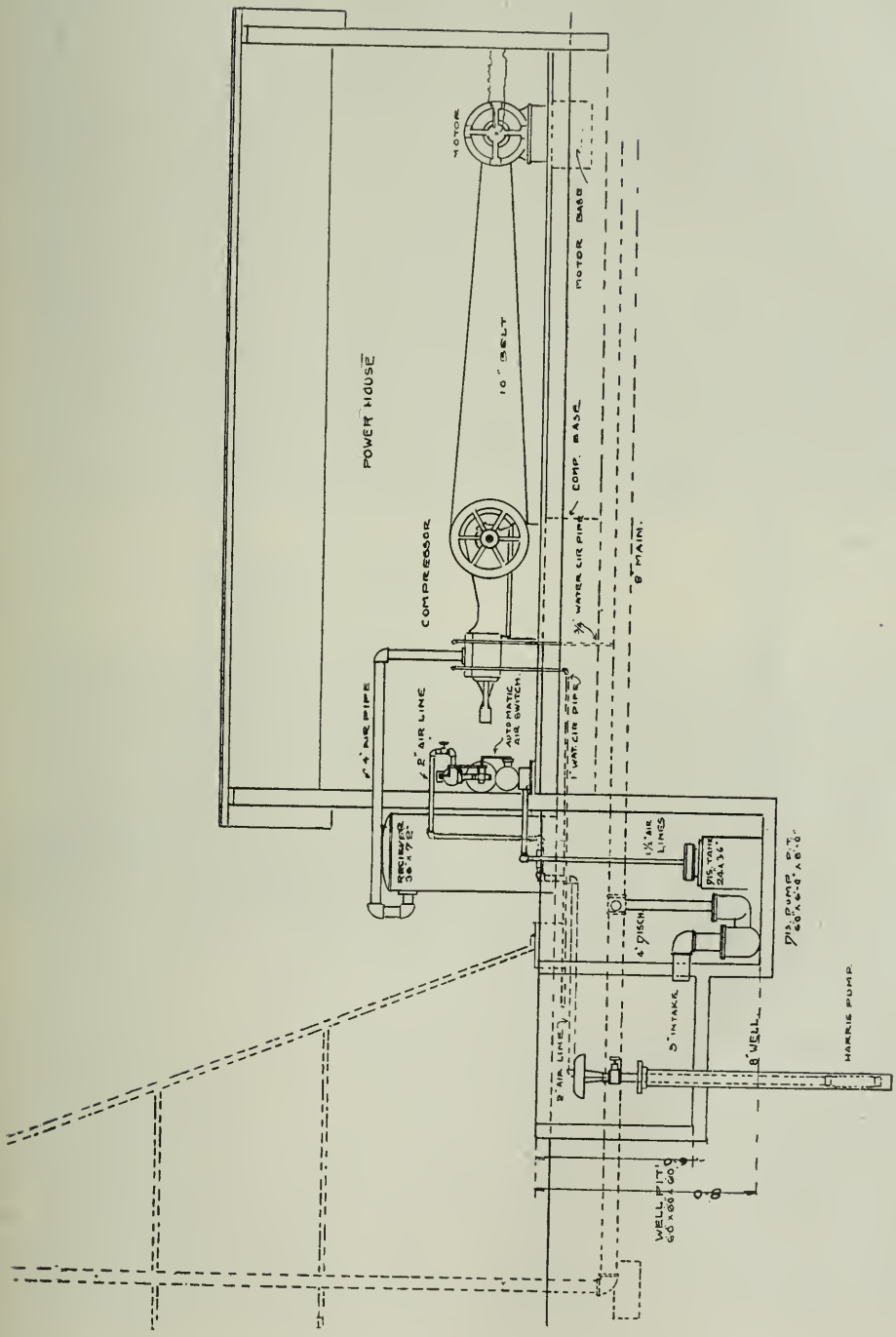
Well Top—An 8-in. standard well top was flanged to top of well, sealing same and is provided with branch air lines leading to pump and through flange. These lines have independent adjusting valves and are so arranged as to back blow and clean well when necessary. The 4-in. water discharge line terminates just above the well top in an umbrella separator, separating the air from the water in the cement basin built around the well top.

Displacement Pump—One Standard Harris Air Pump Company's displacement pump was installed, having duplex vertical steel tanks 24-in. diameter by 36 in. high. These tanks with 5-in. inlet and 4-in. discharge valves were installed in a cement basin or dry pit along side of the well basin, so as to fill by gravity and discharge into an 8-in. main leading to city piping system and tower, the top of each tank being connected to automatic switch in power room with separate pipes.

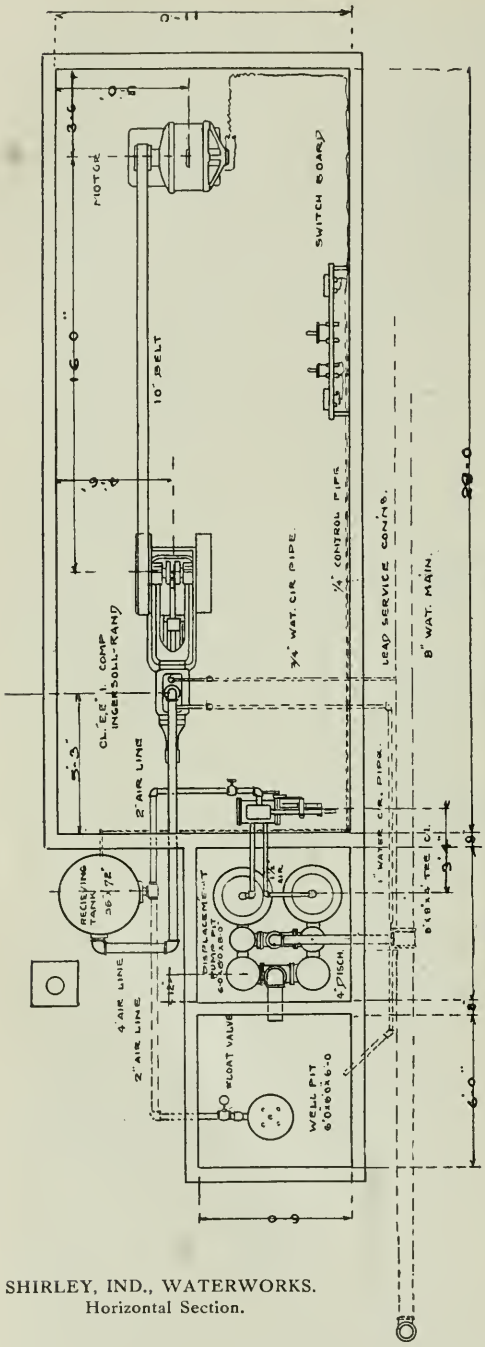
Automatic Switch—This switch is an automatic arrangement and is positive in its action, measuring the air that passes through it and reversing the main three-way valve after enough air has been passed to empty one tank, the air pressure being admitted directly on top of the water in one of the tanks in dry pit, driving the water ahead of it into the main. After enough air has been passed to empty one tank the switch releases the pressure in this tank, allowing the air to escape into the atmosphere and putting the pressure upon the water in the opposite tanks, allowing the first to refill by gravity, thus giving a steady discharge. There are no floats or buckets and the switch is entirely automatic.

Automatic Governors—Upon the air line supplying the well with air and in the well basin was installed an automatic balanced float valve, so that the water level in the well basin would stop and start the well. Thus if the well would pump more water than the displacement pump was handling, the water rising in the well basin would stop the well from pumping until enough water had been drawn to drop the float, when the air would be admitted again to the well.

Electric Governors—Connected by wiring to General Electric automatic controller, which is controlled by the direct



SHIRLEY, IND., WATERWORKS.
Vertical Section showing Pumping Station and portion of Water Tower.



SHIRLEY, IND., WATERWORKS.
Horizontal Section.

water pressure from the tower, so that a variation of water level in the tower will automatically stop and start the system.

Receiver Unloader—Upon the air receiver is placed a Harris Air Pump Company's diaphragm valve to release the air pressure when the plant is stopped, so that the motor does not have to build up and start against pressure. This valve is so arranged that the air pressure acting against a diaphragm and against a spring closes a valve, but when the plant is stopped the air coming in contact with the cold water in the tanks causes enough reduction in pressure to allow the spring to open the valve and release the air in the receiver. This valve is small enough so that when the air compressor starts it immediately builds enough pressure to force the diaphragm against the spring and hold the valve closed.

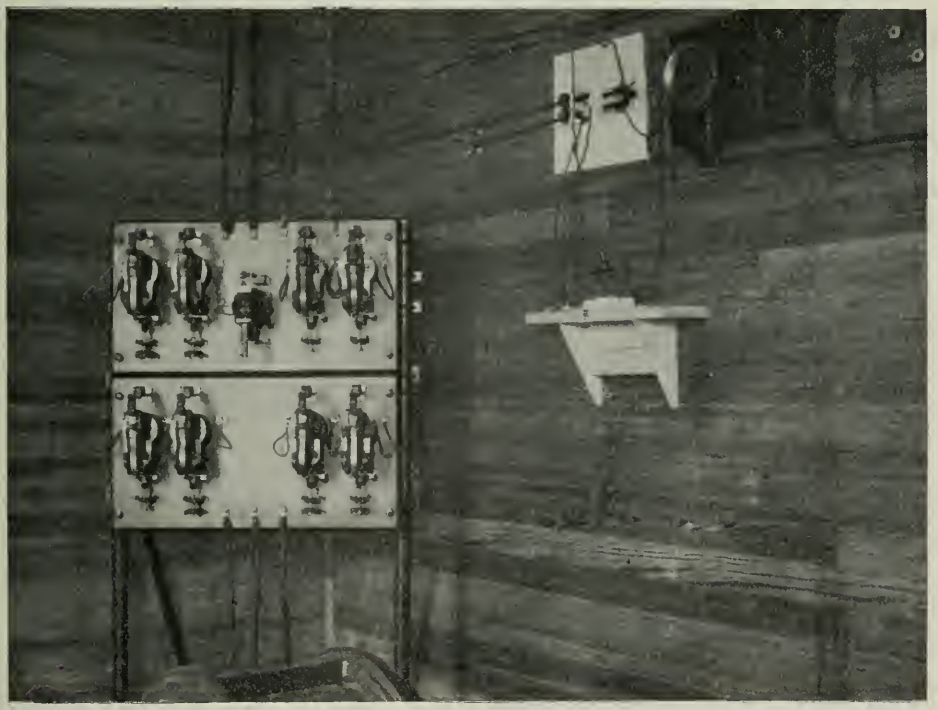
Circulating Water Valve—Upon the pipe line conveying the cooling water to the air cylinder of the compressor a similar diaphragm valve is placed, but so arranged that the air pressure will open the valve and admit water to the jacket, and a release of pressure in the air receiver will close and shut the water off.

SHIRLEY IND., WATERWORKS.
Tank, Pumping Station and City Hall.

The current for the operation of this plant is secured from a traction company passing through the town and is metered, so the town pays only for the actual power used in pumping. It will be seen from the above that the town is here supplied with an automatic water works plant, having a capacity of 288,000 gallons in 24 hours, pumping the water into the mains and tower and controlled by a 2½ pound variation in motor pressure. It requires but little attention beyond filling the oil cups once or twice a day, and in fact has been operated by the town marshal for the past eighteen months.

This whole plant, including power and well equipment, tank and tower, cast iron mains, valves, hydrants, etc., installed cost the town of Shirley less than $9,000.00 and gives them perfect fire protection as well as a reliable and cheap water service.

SHIRLEY, IND., PUMPING STATION AIR COMPRESSOR, TANK AND AUTOMATIC SWITCH.



SHIRLEY, IND., PUMPING STATION. AUTOMATIC SWITCH BOARD.

Field Inspections of Public Service Industries in Wisconsin.*

By J. H. Roemer, Madison, Wis.

THE entire staff of gas and electric inspectors of the Wisconsin Railway Commission at first made headquarters at Madison, but more recently the State has been divided up into three inspectional districts. One of these districts comprises the northeasterly section of the State with a resident inspector stationed at Appleton; a second covers the northwesterly portion with headquarters at Eau Claire; the remainder of the State, comprising the entire southerly portion and a narrow strip between the other two districts, is administered from the staff headquarters at Madison. The results obtained under this latter plan have proven satisfactory both as regards the efficiency of the inspectional work and as to the economy in administering the work of the staff.

In reviewing the work thus far accomplished by the inspections of gas and electric service under the Wisconsin public utilities law, special interest centers in a statement submitted to the Commission covering the operations of the engineering staff for the fiscal year ended June 30, 1908. This statement, it should be borne in mind, was prepared in the light of an experience of considerably less than one year's time, since active operations along technical lines under the utilities law began late in the calendar year 1907. Following is a quotation from the statement referred to:

"The work performed by the special staff of two experts engaged in inspections of gas and electric service consisted in the study of conditions existing in various cities of the State, and included observations on the accuracy of consumers' meters; the accuracy of methods employed by gas and electric companies, in standardizing such meters; the quality of gas as shown by chemical composition and heating value; the pressures at which gas was being delivered to consumers; the pressures and variations in pressure in electrical distribution systems; the efficiencies and deterioration of incandescent lamps; and various other factors relating to adequacy of service. Laboratory investigations have also been made on methods suitable for measuring quality of service, including a study of calorimeters suitable for determining heating values of gas. Special attention has also been given to the investigation of complaints of consumers to determine what factors are the more frequent causes of dissatisfaction. The aims of the work have been to furnish information useful in arriving at the operating values of certain gas and electric plants, to determine to what extent complaints of service made by consumers can be taken as a criterion of the quality of service rendered, and more especially the information was sought as a basis for establishing rules under which the companies may operate so that adequate services may be insured to the consumers.

"During the progress of these investigations numerous instances of poor and inadequate service were found. It appears that, in the majority of cases, the defective service was the result of ignorance or neglect of the conditions due to the lack of suitable supervision or the need of instruments necessary for studying the quality of service. It has been found that in various instances the companies have been needlessly hampered by certain municipal regulations, the purpose of which was to insure good service, but which were actually ineffective. Numerous instances of poor service have been rectified by the public service companies upon their attention being called to the particular defects, and it has been infrequent that such improvements have been made with little or no expense. It has been demonstrated that the consumers themselves are in some measure responsible for the maintenance of adequate service and it has been one of the purposes of the investigation to formulate information serviceable to the consumers in protecting their own interests."

Upon reviewing the foregoing quotation, in the light of the further observations by the inspection staff during the period of two years or more since these preliminary impressions were recorded, it may be said that little is to be added with respect to the character and general scope of the work done by the staff. We cannot do better than to refer for details to the report of the work of the engineering staff contained in the annual reports of the Railroad Commission, particularly in the reports for the years 1909-10. It has been a source of gratfication to the Commission and to its staff that the rules for the regulation of gas and electric service adopted in 1908 should have stood the test of searching criticism directed against these rules from many sources. Among these criticisms none were more searching than those from the Commission's staff itself; for it was scarcely hoped at the outset that a piece of pioneering work

* From a paper before the Illinois Gas Association.

of this sort should escape considerable modification in the light of further investigation and experience. The rules themselves have stood in substantially their original form although it recently became evident that, in order to have uniformity in the interpretation placed upon the rules by the various inspectors and utilities, it would be desirable to explain many details with regard to the exact meaning of these rules. For this reason the inspection staff, with the approval of the Commission, has adopted certain interpretations of these rules with regard to gas and electric service. Owing to lack of space these interpretations will not be presented in this paper, but reference is made to a discussion of this phase of the matter, to be found in the report of the work of the engineering staff for the year ended June 30, 1910.

Information gathered in the course of the preliminary studies by the Commission's staff, in advance of the preparation and adoption of the formal rules, made it plain that in the earlier stages of the administration of these regulations it would be necessary to provide for some flexibility whereby those utilities which were unable to meet the prescribed standards at the outset could be given a reasonable opportunity to swing into line. The spirit of the Commission with respect to such concessions is clearly set forth in the following paragraph quoted from the discussion which formed a part of the decision (U-21) of the Commission promulgating the rules of service:

"If any management anticipates or experiences difficulty in complying fully with such rules and regulations, it is expected that application for a modification of the rule or rules with regard to which difficulties are encountered will be made to the Commission; but until a modification of any rule or regulation herein prescribed has been expressly authorized by the Commission, the gas and electric companies will be expected to comply strictly with the terms of every rule and regulation ordered herein. It is possible that certain plants are operated under conditions which make it impracticable, or not to the best interest of the public, to meet all the requirements of all the rules. Under such conditions it devolves upon the utility to show to the Commission, by complete and convincing evidence, that a modification of some rule or rules should be made. Suggestions and criticisms are at all times welcomed by the Commission."

With the development in the familiarity of operating conditions, due to the more extended personal contact by members of the inspection staff with the various local situations, it has, of course, become practicable to distinguish intelligently between instances of poor service, where there was considerable justification for the same, as distinguished from those cases where the application of the penalty provided by the law should ultimately be called for. During the past year in particular it has been the policy to follow up more persistently cases of serious violations of the rules. Without going into detail in this phase of the question, it may be stated in brief that there has been, with few exceptions, a steady and gratifying response on the part of the managements of the various utilities in the direction of meeting the standards of service prescribed by the Commission. It was believed that, by exercising due patience in this "follow-up" process, it might be practicable to avoid altogether the application of the penalties provided for infraction of the public utilities law with respect to the quality of service. It was with much reluctance that the Commission was finally obliged to abandon this hope, since it became necessary to take vigorous steps toward meeting the requirements of the law. Judging from the results of this recent action, there is reason to believe that the penalties need in future be applied only in very exceptional cases.

Summing up the experiences thus far gained along the lines above discussed, it may be said there has been a steady and distinct development throughout the State towards the establishment of a better understanding between the managements of the utilities and their patrons. Just to what extent this change is due to the fact that there has been an actual improvement in the quality of service rendered it is difficult to say; although it is certain that this phase of the matter has considerable influence in bringing about a readjustment of the viewpoint of public utilities officials. Some utilities, which had not given attention to the satisfactory maintaining of the service until obliged to do so, have come to view the matter from another angle; and this readjustment of viewpoint, it is believed, must necessarily in the long run lead to a cultivation of a spirit of legitimate pride in the quality of service rendered to consumers. The impression of those in contact with this work throughout the State is that the outlook is decidedly favorable.

The foregoing discussion of the quality of service has centered chiefly upon standards of gas and electric service and the administration of the same. Lack of time prevents going into detail with respect to field inspections relating to telephone service. These inspections have been made to a large extent by the staff busily engaged about the State in gas and electric service inspections, although

during a part of the year the time of one skilled inspector was given exclusively to secret tests of the telephone service rendered by the principal exchanges throughout the State. A careful analysis and study of the data thus gathered, confirmed by a somewhat extensive contact through personal interviews and correspondence with the officials of telephone companies, warrant the belief that the general hopeful outlook, with respect to the quality of service rendered by telephone companies, is not essentially different from that just stated in regard to gas and electric utilities.

There has also been considerable activity along the lines of testing the quality of service rendered by water companies. These tests have related chiefly to the quality of the water supplied and to the character of fire streams provided in various cities and villages of the State. There has also been some agitation of the question of the accuracy of water meters. An equipment has been provided for making the field observations along these and related lines, and it is believed that considerable progress will be made in the next year or two in the establishment of a basis for intepreting adequacy of service in these utilities. Reference should also be made to some investigations which have been made relating to the quality of service supplied by heating companies.

Throughout these investigations, a large proportion of which have been of an entirely informal character, there has appeared a genuine appreciation of the fact that these matters, many of them the cause of much irritation, could be referred for adjustment to a body with investigating and regulating powers and having no interest whatever in the outcome.

Rebuilding an Old Brick Sewer in Newark, N. J.*

By Edward S. Rankin, Engineer of Sewers and Drainage, Newark, N. J.

THE first sewers in Newark were built in 1854. They were large brick sewers, have required comparatively few repairs and are still in good condition after more than fifty years' service. As a rule we find these older sewers in better shape than those built twenty years later. One of these latter is now being entirely rebuilt. The street through which it runs was about to be repaved and an inspection showed the sewer (a three-foot circular brick) to be so badly cracked that it was considered unwise to pave the street without first rebuilding the sewer. In several places bricks had fallen from the arch, and for long stretches the arch had settled, one measurement showing only 26 inches in height instead of the original 36 inches. A width of 40 inches was also found. The sewer is situated in a flat, low-lying section of the city and in places has a covering of only two feet, over which a street railroad is built. The jarring caused by the cars probably partially accounts for the condition of the sewer.

As was customary at that time, the sewer was built on a cradle of one-inch hemlock boards rising about half way to the springing line, and the five or six bottom courses of brick were laid dry for the purpose of draining the ground. The remaining courses were probably laid in Rosendale cement mortar, but there is very little adhesion between the mortar and brick, and the mortar itself is readily crumbled with the fingers. On excavating for the new work it was found that for part of its length the sewer was built through running sand and at the present time soft clay overlaid with black mud is being encountered.

The sewer now being encountered is of slightly larger size, being egg-shaped, three by four feet in diameter, laid in one to two Portland cement mortar with invert of paving brick. Where the soil is too soft to be excavated to the shape of the invert, a platform is laid and the sewer built in a brick cradle. In better ground a two-inch hemlock cradle is used, supported every 6½ feet by spruce ribs sawed to shape.

The flow in the old sewer is being handled by keeping a sandbag dam in advance of the new work and pumping the water from the nearest manhole above with a six-inch centrifugal steam pump, from which it is run through the street gutters to the nearest catchbasin below the finished work. Ground water and flow from house connections and laterals are taken care of by means of a double diaphragm gasoline pump.

Work is progressing at an average rate of about thirty feet per day.

*Paper before the American Society of Municipal Improvements.

Bituminous Surfaces for City Macadam Streets.

By J. C. Travilla, Street Commissioner, St. Louis, Mo.

THE macadamized paved streets of a city may be greatly improved and the cost of maintenance reduced to a minimum by the judicious use of oil, oil-asphalt or coal tar for surface treatment.

Having studied traffic conditions and determined the grade of oil to be used, good results are not assurred unless the roadway has been properly prepared: it should be free from moisture and thoroughly cleaned, leaving the exposed macadam free from dust.

St. Louis has specifications for four grades of oil for surface treatment, and from careful study of results during the past three years, I am satisfied that there is place for each grade.

The grades of oil used are as follows:

No. 1—Residuum oil having a gravity of 30 deg. Be., is applied cold and is used on cinder roads and for the purpose of giving life to the surface of a road that has previously been treated with a heavier product and is becoming dusty. Being merely a dust layer, it should not be considered as having any binding properties.

No. 2—Residuum oil having a gravity of 20 deg. Be., is applied hot and is recommended for park roads and for roads that are not main arteries of travel.

No. 3—Residuum oil having a gravity of 16 deg. Be., is applied hot and is used on the main thoroughfares having a mixed traffic and acts as a temporary binder for the mineral matter.

No. 4—An oil-asphalt compound having a gravity of 12 deg. Be., is applied hot and is recommended for any type of road, since it simply forms a binder for the mineral matter which actually bears the traffic.

In the use of all the grades of oil referred to, with the exception of No. 1, there should be a covering of mineral matter, uniformly distributed over the surface of the oil to a depth of from one-fourth to one-half inch, depending upon the amount and gravity of the oil applied. The mineral matter becomes coated with bitumen, forming a bituminous mat which acts as a roof for the surface of the macadam and as a cushion coat to prevent the abrasive wear of the macadam. The life of the road and the success of the treatment depend upon the quality and grading of the mineral matter used in forming the bituminous mat, as much as upon the grade of the oil-asphalt or coal tar. Limestone found in this section of the country is very soft and does not make a good wearing surface; however, it is well adapted for the base of a road. We are fortunate in being able to obtain a graded creek or river gravel which is harder than limestone and has excellent wearing qualities.

The work of treating a road surface after applying the oil and mineral is not completed for several weeks. As soon as the road is open to traffic, it is necessary to give it attention for some time to take care of any wet spots that may appear.

It must not be presumed that surface treatment will provide a dustless roadway from April to November, without any additional work. What would be the appearance of any improved street, under heavy traffic, if not properly cleaned for a period of six months? It is therefore necessary to properly patrol treated road surfaces to keep them in a cleanly condition. It is also essential that all road intersections be treated, as the dust and dirt carried onto a road will materially shorten the life of the treatment.

When traffic and road conditions have been ideal, we have had surface treatments to last through two summers with every indication of at least a year or more wear without attention other than the maintenance. This condition, however, will not exist on the average highway and it is not reasonable to presume that a road receiving such a wearing surface should have a long life. The cost of treatment being inexpensive, considering the results, the work may be done each year.

It costs from $450 to $700 per mile per annum to properly sprinkle a road with water, exclusive of maintenance. Oil treatment will cost from $400 to $800 or $1,000 per mile per annum, depending upon the width of the roadway, the time spent in its preparation and the grade of oil used, as well as the amount of mineral matter required for covering.

The maintenance of a road that has been oiled instead of watered will be reduced to a minimum. A street that has been watered is either muddy or dusty; on the other hand, a street that has been oiled is dustless as long as there is life in the oil.

I believe I am safe in saying that the greatest advance in road work of the past century has been in the surface treatment of roads. We have made mistakes and lack of experience has produced poor results; but I feel that each year's work indicates progress.

I have read that the council of a city in determining which was the greater nuisance, an oiled road or a dusty road, decided that the use of oil was the greater. Such criticism may probably be just when the work is improperly handled.

We have miles of oiled macadam roads and have yet received no unfavorable criticism. On the other hand, there is a continued request to treat roads with oil.

City roads and pavements are yearly becoming a greater issue in every municipality. The vast sums being continually expended for improvement and maintenance, together with the comfort and economics, or lack of same that result, are drawing the best thought of the engineering profession to the subject. We, here in St. Louis, realize not only its importance, but also its inevitableness, and are beginning to feel that we have the work well in hand.

The Ohio State Experiment Road.

(A Correction.)

In the article on "The Ohio State Experimental Road," on page 179 of the September number, occurred an error in makeup on page 181 which seems to attribute to Experiment No. 3 with Pioneer Asphalt Cement an occurrence which really happened in Experiment No. 2 with Standard Macadam Asphalt Binder. The references to the photograph makes the error apparent and is a correction of it to the careful reader. To set the writer of the article right the description of the observations on the two experiments is here repeated, arranging the paragraphs in the proper order.

EXPERIMENT NO. 2—STANDARD MACADAM ASPHALT BINDER.

The section of road on which this treatment was applied was first prepared in the usual manner of treatment for the lower course of a water-bound macadam road. Crushed limestone, ranging in size from three inches to one and one-half inches, was then spread to a depth of about three inches. This course was then rolled with a ten-ton roller until it presented a fairly smooth and uniform surface. The asphaltic binder, which had been heated in a small tank at the side of the road, was then applied by means of hand sprinkling cans. About one and one-half gallons of the binder was used for each square yard of surface treated. Screenings varying in size from one-half to three-fourths of an inch were then spread upon the road and the roller again brought into use. Additional screenings were added where the binder appeared on the surface, and this work of rolling and adding screenings continued until no more binder appeared on the surface. On a portion of this section a second coat of the binder, consisting of from one-fourth to one-half of a gallon per square yard was applied, followed by another coat of screenings and more rolling.

Asphalt has been forced to the surface to a degree that it has flowed to the side of the road. The temperature at the time of inspection was only about 85 degrees and yet the imprint of the horses' hoofs

SECTION II. STANDARD ASPHALT BINDER.
Ohio State Experimental Road.

Section III. PIONEER ASPHALT BINDER.
Ohio State Experimental Road.

was plainly visible at points on the surface where the asphalt had exuded to a great extent. Excepting for these points the surface is hard and dustless. Photograph 2 shows this section. [This is the photograph which was misplaced.—Ed.]

EXPERIMENT NO. 3—PIONEER ASPHALT CEMENT.

The material used as a binder in this experiment is refined from rock asphalt mined in Utah. In the construction the foundation course was finished as a water-bound macadam road, thoroughly rolled and bonded. The second layer was composed of stone ranging in size from one and one-half to two and one-half inches. This was rolled to a finished depth of about two inches, no water being used. One-half to three-fourths inch screenings were broomed into the surface in a quantity sufficient to reduce the voids about 50 per cent. The asphaltic cement was then poured at a temperature between 390 deg. and 410 deg. F., until all of the stone was thoroughly coated. When the coating had cooled, a thin dressing of screenings was sprinkled over the surface. These screenings were sprinkled but a short distance ahead of the roller, which followed immediately after the screenings were placed. The screenings were sprinkled at first in a thin layer, and as the rolling proceeded more screenings were added, until the coating had absorbed all the screenings which it was possible to absorb. The quantity of the binder used was one and one-fourth gallons per square yard.

The surface is smooth, dustless and in excellent condition, with no excess of binder. Photograph 3 indicates this condition.

EDITORIAL COMMENT

The American Association for Highway Improvement.
American Society of Municipal Improvements.

THE AMERICAN ASSOCIATION FOR HIGHWAY IMPROVEMENT.

MUNICIPAL ENGINEERING desires to call special attention to the meeting of the American Association for Highway Improvement, which will be held in Richmond, Va., November 20 to 24, 1911. This is a new association with the highest aims possible, supported by the most influential advocates of the cause of good roads and largely in charge of the national good roads enthusiasts who have no hobbies to ride, no axes to grind, no political ambitions to gratify, no business interests to foster. As a consequence the organization is taking the lead even in advance of its first convention.

The membership in the association is rapidly approaching the 1,000 mark and many local, state and district associations have affiliated themselves with it, recognizing it as the national organization and clearing house. The association maintains a few men lecturing and organizing working road clubs, and they, with the officers of the society, aid in the preparation of laws and in installing methods of organizing and maintaining good roads work.

The program for the November convention is not yet complete, but will be published so far as ready in the November number of MUNICIPAL ENGINEERING. It provides for National Day, with President Taft, Highway Engineers' Day, Road Users' Day and the Association's business day.

Several so-called national associations have held or are to hold conventions during the summer and fall, but unfortunately they all have some special interest among those named above which they are trying to promote. It is a pleasure to recognize the independent course of the new association and to commend its honesty of purpose and the efficiency of its management.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The program of the American Society of Municipal Improvements is given elsewhere in this number, so far as presented by the management. The convention is in session as this number is on the press so that report of its discussions must be postponed until the November number. Three of the papers presented are among the leading articles, two of them being complementary upon the subject of expansion in brick pavements.

The committee on standard specifications and its sub-committees have a large part of the program and the chairmen of these various committees promise full reports. The members of the corresponding committees of the Association for the Standardizing Paving Specifications were invited to meet with the committee immediately preceding the convention and a number of them accepted the invitation. This indicates that these two national organizations are approaching agreement upon the important features of the standard specifications and may, by the work at this meeting and at that of the latter organization at New Orleans in January, be able to present forms upon which all may be able to agree.

Each engineer is liable to have some special point of detail upon which he differs from standard practice, and it may be that the finally adopted specification will drop some details, holding to the essentials on which all can agree and leaving those less important matters upon which, for one reason or another, agreement is impossible, for determination by the local engineer.

Differences in climate, in materials, in character and quality of workmen, as well as differences in experience of engineers and their personal equations make necessary differences in details, sometimes in very important details, so that it is not possible for a standard specification for universal adoption to cover every detail. This is recognized to some extent by the members of both associations, but there are some contentions which are based on these irreconcilable differences, and the only way to avoid them is to drop these points out of the specifications.

THE QUESTION DEPARTMENT

RMP

Gutter for Steep Dirt Road.

Have you in your records any design in regard to a paved gutter either of brick or concrete to be used on dirt roads having a steep grade?

The proposition is that we have several steep roadways which will require a gutter to protect the same from the wash caused by a heavy rainfall. I would appreciate any information that you could give me on this subject. . F. P., Wadsworth, O.

If a curb is not used such a gutter can be made of cobble stones, brick or concrete in the form of a very flat V with flat slope next the roadway and much steeper slope outside up to a berm or sidewalk. The cobble stone or brick may be laid in gravel and sand or in concrete so as to be as solid as possible. There is always a tendency for the dirt roadway to wear down into a rut below the level of the paved surface and thus prevent the water getting to the gutter, but if a considerable crown is given to the road and it is filled and rolled until it is certainly higher than the paved surface at every point and then every rut or washed place is repaired as soon as it is formed, the drainage can be kept in good shape. A concrete gutter can be made in the same shape, using the same specification as for a cement walk and taking the same precautions as to construction of roadway and prompt repair of ruts and washes.

If a curb is used, slabs of stone or concrete may be used as well as the cobble stones or brick, making the gutter necessary width to carry water and using the outside berm or sidewalk border. This gutter is subject to the same defects as the gutter above described.

Practice with regard to such gutters is given in more or less detail in a dozen or more places in Byrne's "Highway Construction," ($5) and some data will be found also in Baker's "Roads and Pavements," ($5).

Disposal of Sewage and Refuse.

Send what information you can on disposal of sewerage and dead stock and garbage. W. L., Mayor, Texas.

The back numbers of MUNICIPAL ENGINEERING are the best source of information as to the advance in the disposal of the city's wastes. The following are recent articles which are worth careful study:

On sewage disposal:

The series of articles on "Sewage Disposal with Respect to Offensive Odors," in vol. xl, pp. 395 and 484, and vol. xli, pp. 27, 116, and 192.

In vol. xli: "Disposal of Single House Sewage", p. 42, with references to earlier articles: "Sewage Disposal in Bowling Green, Ky.," p. 149.

In vol. xl: "Sewage Disposal Plans of Atlanta, Ga.," p. 1; "Modern Sewage Disposal," p. 181; "Patents on the Septic Tank," with reference to earlier articles, p. 219; "Sewage Plant at LaGrange, Ill.," p. 226; "The Electrolytic Sewage Treatment Plant at Santa Monica, Cal.," p. 229; Information about sewage disposal in many cities, p. 264; "Purification of Brewery Refuse," p. 432; "Purification of Woolen Mill Waste," with references to earlier articles on the disposal of trades wastes, p. 516; "The Report of the Milwaukee Sewerage Commission," p. 529.

In vol. xxxix: "Sewage Purification by Irrigation," p. 38; "Covers for Septic Tanks," p. 39; "Purification of Dye Water," p. 88; "Use of Sewage for Irrigation at Fresno, Cal.," p. 117; "Cameron Septic Tank Patents," p. 238; "Books on Sewerage and Sewage Disposal," p. 291; "The Present Use of the Septic Tank," p. 349; "Books and Patents on the Septic Tank," p. 390; "Books on Sewage Disposal," p. 391, with references to earlier lists of books and articles on the subject; "Eastern Installations of Septic Tanks and Contact Beds," p. 470; "Prevention of Odor from Septic Tank Effluent," p. 470.

On refuse, garbage and dead animal disposal:

In vol. xli: "New York's Economical Refuse Disposal," p. 33; "The Pittsburg Garbage Problem," p. 61; "Garbage Disposal in Montclair, N. J," p. 147; "The Milwaukee Refuse Incinerator," p. 148.

In vol. xl: "Reduction of Garbage," p. 36; "Garbage and Refuse Collection and Disposal," p. 106, stating in some detail the principles on which the work must be based to be satisfactory, and giving some details of practice; "Review of Morse's "The Collection and Disposal of Municipal Waste," ($5) p. 143, this book being the latest and giving the fullest reports of practice, but largely devoted to methods of disposal; "The Garbage Crematory at Houston, Tex.," p. 177. Information about garbage collection and disposal in many cities, p. 281; "The

Municipal Garbage Reduction Plant at Columbus, O.," p. 322; "Regulations for Collecting Garbage at Householder's Expense," p. 348, giving the methods in use in several cities; "Cities Operating Garbage Incinerators," p. 427; "Suggested Garbage Receptacle Ordinance for St. Louis," p. 445; "Test of *Decarie* Garbage and Refuse Incinerator," p. 460.

The series of articles on "Town Scavenging and Refuse Disposal" in vol. xxxvii, p. 287, vol. xxxviii, pp. 1, 73, 143, 229, 299, and 381, and vol. xxxix, pp. 1 and 85.

In vol. xxxi: "Sewage and Refuse Disposal in Memphis, Tenn.," p. 4; "Municipal Abattoir," with reference to earlier articles giving descriptions of particular installations, p. 33; "Information about Garbage Destruction," with reference to many earlier articles and books on the subject, p. 39; "Los Angeles Has a Garbage Nuisance," p. 54; "The Municipal Abattoir and Reduction Plant at Paris, Tex.',, p. 90; "The Municipal Garbage Reduction Plant at Columbus, O.," p. 135; "Garbage Disposal in Paris," p. 224; "Specifications for New Incinerating Plants for San Francisco," p. 226; "Garbage Collection and Disposal in Minneapolis, Minn.," p. 275; "City Refuse Collection," p. 286; "Refuse Disposal at Somerville, Mass.," p. 319; "Municipalities Operating Garbage Reduction Plants,' p. 471; "Austin Contemplates a Municipal Abattoir," p. 479.

Good books on these subjects not referred to in the above listed articles are, Kinnicut, Winslow and Pratt's "Sewage Disposal," which is reviewed in MUNICIPAL ENGINEERING, vol. xli, p. 67; Schmeitzner's "Clarification of Sewage," reviewed in vol. xli, p. 66; Morse's 'Collection and Disposal of Municipal Waste," ($5) reviewed in vol. xl, p. 143; Moore's "Sanitary Engineering," ($14), reviewed in vol. xxxix, p. 229.

Cost of Engineering on Good Roads.

What per cent of total cost goes into engineering on good road work in various states?
C. E., Oklahoma.

As to road departments this question is not easy to answer from the data given in the reports of the various state highway departments and often can not be determined in any way with accuracy because the funds expended come from different sources and the accounts are kept in different offices and sometimes in no office, so that the total cost is difficult to obtain and the itemized cost is not available. Some idea may perhaps be gained from the following gleanings from state reports. Their accuracy is not great as the data are meager and the methods of keeping accounts are not explained in the reports, and there is much overlapping of contracts from one year into another.

The cost of engineering and inspection may be paid from state funds and it may be paid from local funds or in part from each. It is paid for many roads by the local authorities and for others from state funds. There is also the cost of operating the state highway office, much of which should be charged to engineering.

State road contracts in fifty municipalities in Maine, which were estimated and supervised by the state department and partly paid for by it, were apparently laid out and inspected by the local officials. In some cases there is no charge for engineering and inspection. In some cases a charge is made for engineering alone, which varies from about 0.5 to about 5 per cent,, and would average perhaps 2 to 2.5 per cent. In some cases a charge is made for engineering and inspection, which varies between 3.5 and 10 per cent. Where the two charges are separated engineering is about 35 to 40 per cent. and inspection about 60 or 65 per cent of the total charge for this work. The cost of inspection of roads wholly under the state department is carefully kept and reported. This cost varies between 2.2 and 6.3 per cent. of the total cost of the contract, averaging 3.2 per cent. The difference in percentage of cost of inspection is attributed to the fact that a large part of the cost is not dependent on the amount of the contract, so that a large job will show an inspection cost percentage much less than a small contract. The cost of operating the state highway commission office, aside from the inspection referred to, is a little less than 3 per cent. of the gross expenditure on state aid and trunk line roads or about 5.7 per cent. of the expenditure by the state on these roads. These data are collected from the last annual report of the department and agree fairly well with those of earlier years, except that 1909 shows generally higher cost of engineering and inspection.

The expenditures of the engineering department of the Massachusetts state highway department are not given, nor is there any indication of the amount of engineering and inspection paid by the local authorities. The text of the report shows, however, that plans and surveys are generally made by the state and apparently the construction is also inspected by it. The summary of expenditures of state funds, omitting those not directly connected with road construction and repair, and accepting the general expense item as the cost of the state highway department proper and the engineering work, indicates that these general expenses are 7 per cent. of the total expenditures of the state for construction under all road and bridge appropriations. Road repairs and mantenance required 80 per cent. as much money as construction and were also supervised by the department. If the cost of the department and its engineering force is distributed over the entire construction, repair and maintenance account, the percentage is reduced to 3.8.

The Rhode Island reports are so meager that no reliable statement can be made. Ap-

parently the cost of the state road office is only about 1¼ per cent of the total expenditures for construction, about one-third of this being for engineering assistance. But as the total cost of the office is less than $5,000 a year it is evident that the major part of the engineering and inspection cost is included in the construction account, which is given only in grand totals.

In New Jersey reports the engineering and supervision charges are shown in more or less detail. Some roads show a supervisor's salary only, which ranges from about 1 to 8 per cent. of the cost of the road, averaging about 2¾ per cent. Where the cost of engineering services is given it varies between 2 and about 6¼ per cent. averaging about 3½ per cent. Where the engineering and supervision are not separated the total cost of the two ranges from 4 to 10 per cent. and averages about 6¼ per cent. These figures seem not to include the cost of the state highway department organization, and no information is given upon this point, nor is there any statement of the number or kind of employes on which to base an estimate.

The Pennsylvania reports state definitely the percentage of cost of engineering and inspection, the latest annual report giving the cost of engineering as 2.2 per cent. and the cost of inspection as 2.9 per cent. of the total cost. The cost of each is given for each road constructed during the year. The cost of operating the department is not given separately.

In the state of New York the development of highways has been so rapid that it is not possible to compute accurately a percentage cost of engineering, so much of the work of the department being upon the surveys and plans for future work, the cost of which does not show in the construction expenditures for the year. Going back to the administration of the State Engineer, and remembering that some of this development took place at that time, one can compute from the reports of the division engineers total cost of engineering as from 11 to 14 per cent. of the actual payments on contracts during the year. This apparently includes all engineering and inspection and cost of the division offices but not of the central office. The figure is probably too large for the reasons stated.

Court Decisions on Water Works Questions.

I have been reading with interest for several years the decisions you have quoted from time to time in the water works department of your magazine.

I have wondered if you have had them compiled in any form that we could purchase a copy.

STURGIS WATER WORKS CO.,
Sturgis S. D.

The brief extracts from "Decisions of the Higher Courts of Interest to Municipalities" are taken from the reports of cases in the series of court reporters published by the West Publishing Co., Minneapolis, Minn., and most of the decisions quoted in more detail are reported in the same publications. There is an occasional compilation of a text book on subjects which might include the material desired but the writer is not familiar with the books. Inquiry of the West Publishing Co., Minneapolis, Minn., and of the Bobbs-Merrill Co., Indianapolis, Ind., will bring catalogs of the law books they publish.

Some years ago the American Water Works Association published two or three digests of court decisions on questions of interest to water works men. Possibly copies of these can still be obtained from John M. Diven, secretary, 14 George St., Charleston, S. C.

Information About Garbage Collection and Disposal.

I am interested in the disposal of garbage in cities by a system of collecting from house to house. Can you inform me what cities have a plan of this sort and where I can get literature pertaining to the subject? If MUNICIPAL ENGINEERING has had articles on this subject can you tell me how I can get such numbers?

B. A. C., Dallas, Tex.

MUNICIPAL ENGINEERING has published much upon the subject. Recent articles upon the subject are listed in this department in the article on "Disposal of Sewage and Refuse."

Book on Water Rates and Water Works Management.

We are seeking some meritorious work on water rates, management of water works, etc. J. J. MCMAHON, Mobile, Ala.

The subject of water rates and the principles of their determination is under too strenuous discussion to have found its way into text books to any large extent. MUNICIPAL ENGINEERING has kept quite full record of the development of the subject as the following list of articles will show:

In vol. xli: "Rights of a Municipality in Fixing Water Rates," p. 57; "Water Rates in Small Cities," p. 131, giving comparisons of these in many cities.

In vol. xl: "Water Rates in Municipal Plants," p. 103; "Charges for Sprinklers and Standpipes for Fire Protection," p. 120; "Rate Making," p. 319; "Water Rates of American Cities," giving references to a number of earlier articles on the subject, p. 344. In the article on "Value of Water Works Franchise," p. 428, will be found some references to rate determinations; "Water Works Management," p. 493; "Determination of Water Rates for Madison, Wis.," p. 502. There are also a number of articles descriptive of water works systems which will be of interest in this connection.

The question of rates and rate making has been discussed at some length in water works associations and papers on the subject can probably be obtained from John M. Diven, secretary of American Water Works Association, 14 George Street, Charleston, S. C., and from the New England Water Works Association, 715 Tremont Temple, Boston, Mass.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Method of Maintaining and Correcting Assessment Maps.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In the year 1905 the City of Passaic adopted a new method of maintaining and correcting its assessment and taxing maps. Before that year a system had been in vogue which was found faulty and very inconvenient. It had been the custom to denote all changes and transfers of real estate by various colored inks on the original maps. The first change would be marked in red ink, the following change in blue ink, and subsequent sales or transfers of real estate would be indicated by other colored inks. The unusually rapid growth of the City of Passaic and the very many subdivisions and real estate transfers, which were the result, increased quickly the delineations on the official assessment maps and within a few years the number of changes on the maps were so numerous and became so complicated that it was impossible, without first looking up the description of the property in the office of the register of deeds, and practically making a complete search of the property, to ascertain the time of the transfer and the extent of the same. It was found very difficult for persons interested in real estate and tax searches to determine the exact dimensions and the result was that serious errors were made which caused trouble and expense to property owners.

The board of assessors, as well as the sinking fund commissioners of the city council, realized the necessity of adopting some system which would eliminate the many errors and the serious complications caused by the unsatisfactory conditions of the assessment maps, and at the same time provide for a system of records which would be reliable and permanent. For that reason a committee was appointed for the purpose of looking into the matter and to suggest a method which would be better adapted for the needs of the city. After visiting a numnumber of cities and investigating the methods used in these places, and after giving the whole subject thorough study and consideration, it was finally determined to recommend to the city council a method which would be correct and at the same time eliminate all interlineations of subdivisions on the maps.

The method which was recommended by the committee and afterwards adopted by the city council, consisted in making a complete set of tracings on cloth of all assessment maps showing the latest subdivisions up to date. Black print copies, covering the maps of the entire city were made from these tracings, bound in book forms according to wards, and placed in the office of the city surveyor as blotters. On these blotters were denoted by the city surveyor in lead pencil all transfers which took place during the fiscal year, extending from May to May. The descriptions of real estate transfers were received regularly once or twice a week from the office of the register of deeds and delivered to the board of assessors as well as to the office of the city surveyor. The city surveyor had complete charge of all the maps and it was his duty to indicate on the blotters all transfers of real estate during the fiscal year, and to change the tracings to correspond with the final subdivisions shown on the blotters. Black print copies on cloth from the corrected tracings were then made for the board of assesors and used for taxing purposes during that year. As soon as the work was completed the maps, properly bound according to wards, were filed away for future reference and record.

The following years the same procedure was complier with and new black print copies, after the tracings had been properly corrected and changed, were made for the board of assessors. These copies, properly bound according to wards, as soon as the taxes had been levied, were filed away with the maps of the previous years for future reference and record.

In this manner a complete record of each year's changes were kept by the board of assessors and available to all citizens interested, and the maps were without any interlineations, alterations or changes of subdivisions.

The system has been in use in the City of Passaic for the last six years and has given excellent satisfaction. Searches for any year can be made without any trouble and it is not necessary for the purpose of obtaining the dimensions of any lot or plot to look up the deeds or records of the same. The map shows the exact dimensions of each lot or plot for any particular year for which

the informations are required. The cost is nominal, consisting in keeping the blotters up to date, changing the tracings once a year, furnishing black print copies on cloth of same, and binding the black prints in book form according to wards. Lawyers and other persons interested in real estate, who have had occasion to make researches for taxes and assessments, praise highly the efficiency and simplicity of the system, and the correctness of the same.

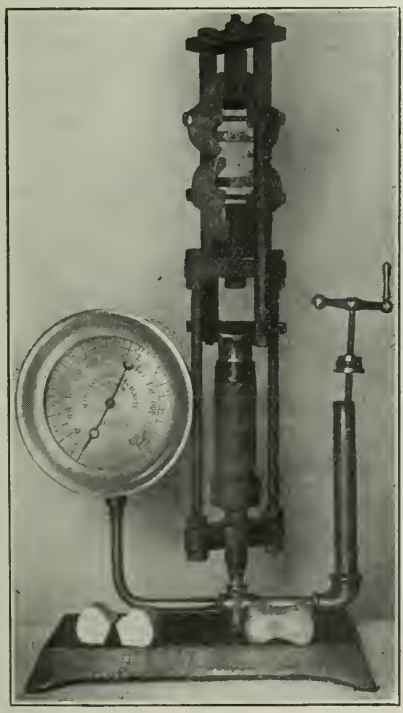
ARTHUR L. PETTERSON.
Civil and Consulting Engineer.
Passaic, N. J.

Cement Testing Machine of Maryland Geological Survey.

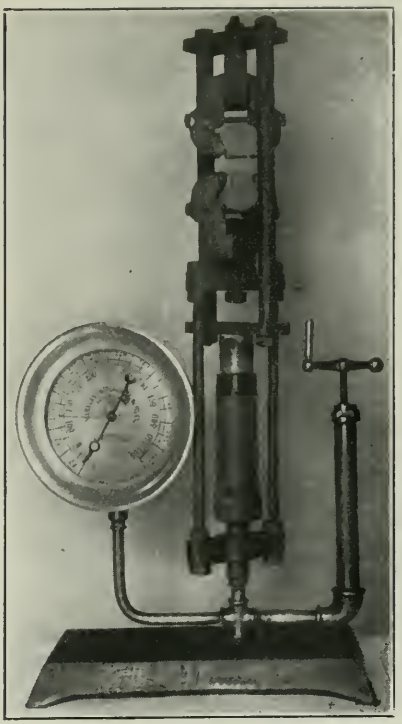
To the Editor of MUNICIPAL ENGINEERING:

Sir—A description of a compact and convenient machine which has been in use for testing cement briquettes in the laboratory of the Maryland Geological and Economic Survey for a number of years, may be of interest.

This machine is easily operated by one man, and, while delicate in its registration, is apparently not readily worn or thrown out of adjustment. It consists of a self-registering hydraulic gauge attached to a piston operated by hydraulic pressure. The piston forces apart the standard clips holding the regular cement briquettes. The piston is actuated by the pressure of the fluid produced by a smaller piston operated by a screw turned by hand. The photographs show the machine (A) Pressure released, small piston loose, and (B) After operation; briquette broken and breaking pressure recorded.



(A.) CEMENT TESTING MACHINE.
Pressure Released.



(B) CEMENT TESTING MACHINE.
After Operation.

The cross section of the larger piston being two square inches in area, the breaking strength per square inch of the briquette is double the figure recorded by the gauge in use. The compactness of the machine, its simplicity and cheapness have commended it to our use. For the liquid in the cylinders and tubes, any oil is used with satisfaction.

This machine was made from the original machine designed by Highway Engineer A. N. Johnson for testing cylindrical rings of cement, a full report of which may be found in the Third Report on the Highways of Maryland, Maryland Geological Survey, vol. v, 1903.

The necessary alterations of the original machine were made for the writer by the machinist of the survey, J. M. Brooks, in 1906, as, in the work of the office, it was decided to continue all cement tests on briquettes according to the specifications recommended by the American Society Civil Engineers.

MAJ. W. W. CROSBY.
Chief Engineer Geological Survey.
Baltimore, Md.

Protection of City for Pavement Defects Developing After Completion of Contract.

To the Editor of MUNICIPAL ENGINEERING:

Sir—All experienced officials now agree that there should be no time-guaranties, but that a pavement should be properly constructed at the beginning, and the engineers held responsible for the results. But if through accident, oversight, neglect or other cause a pavement, already finished and paid for by a city, is defective, the city can be fully protected by having inserted in the general requirements of all its paving contracts the following clause:

NO ESTOPPEL.

The city shall not be estopped by any return or certificate made or given by any engineer or other city officer, agent or appointee of the city from at any time (either before or after the final completion and acceptance of the work and payment therefor pursuant to any such return or certificate) showing the true and correct amount, quality and character of the work done and materials furnished by the contractor or any other person under this agreement, or from showing at any time that any such return or certificate is untrue and incorrect, or improperly made in any particular, or that the work or materials, or any part thereof, do not in fact conform to the specifications; and the city shall not be estopped, notwithstanding any such return or certificate and payment in accordance therewith, from demanding and receiving from the contractor such damages as it may sustain by reason of his failure to comply with the specifications.

I make the above suggestion in the interest of taxpayers, cities and officials endeavoring to obtain durable and economical pavements.

J. W. HOWARD, C. E., E. M.
Consulting Engineer, New York City.

Expansion and Contraction in Wooden Block Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In your June issue, 1911, on page 515, "C. H. S. of N. Y." asked for advice as to the best method of preventing the swelling of wood block pavement on bridges.

In your reply you stated "some ten years ago I described the observed contraction of block pavements under continuous cold weather, with consequent opening of joints, and even cracks across the blocks, * * * ."

Your remarks would apply to brick pavement, but would they apply to creosoted wood block pavement? Do wood blocks contract under continued cold weather?

On the contrary, my observation has been that wood blocks contract under heat and expand under cold—and that it is when the temperature drops considerably in a short time that the wood block pavement buckles, if at all.

Of course a pavement made of untreated wood blocks will buckle during a long wet spell, but my experience with creosoted wood block pavement has been that the trouble comes only in very cold weather, when the temperature is about 32 degrees, Fahr., and drops to zero in a night.

While commissioner of works of Atlanta, I had on two concrete viaducts the creosoted wood block pavement to buckle in two or three places during just such a climatic change. On examination I found the blocks did not show complete penetration—the treatment seemed about 16 pounds of light oil of creosote per cubic foot of timber, and the blocks had been closely laid without proper provision for longitudinal expansion; also that a pitch filler had been used. Atlanta has four other viaducts paved with creosoted yellow pine blocks with which there has been no trouble whatever, and after from four to six years of service, there is no sign of wear or decay, and not one dollar of expense for repairs.

As consulting engineer for "the Yellow Pine Manufacturers Association," I was called on to investigate the cause of the buckling of the creosoted wood block pavement on a bridge in Joplin, Mo., and also one in Omaha, both light steel structures. On examination I found that the creosoted wood blocks on both bridges had been laid very close on sand cushions with pitch filler and without provision for sufficient longitudinal expansion. The blocks were made of satisfactory timber—were treated with about 16 pounds of creosote oil to the cubic foot of timber—cant say that the penetration had been as thorough as it should have been, still, after three or four years under service, the blocks showed no wear nor sign of decay. There is no doubt but that the buckling of the blocks was due to want of proper longitudinal expansion along the curbing, and the use of pitch as a filler. (Transverse expansion joints are altogether unnecessary and should be left out.)

When the wood blocks expanded from cold and the steel members contracted, the wood blocks having been closely laid with pitch filler, something had to give, and following the path of least resistance came the buckling of the blocks. The pitch filler contributed to rather than relieved the trouble. Below freezing point pitch is as unyielding as the coal from which it is made, and therefore, is absolutely unsuited as a filler for creosoted wood block pavements. At the very time the wood blocks expand the pitch filler is rigid, as much so as cement grout.

Had an asphalt cement filler been used, so fluxed as not to become brittle above zero Fahr., or flow below 200 degrees Fahr., doubtless the block paving on neither bridge would have buckled. The buckling surely would not have occurred, had proper longitudinal expansion joints been also provided at the curbing, filled with asphalt cement, fluxed as above specified.

On the Omaha bridge the blocks also suffered from the sand cushion sifting out through the cracks of the floor timbers, and because of an uneven foundation many of the blocks split under the heavy traffic.

I have given the better part of the past sixteen years to the study of creosoted wood block pavements—have critically inspected almost every street and bridge so paved in the United States, and while I have not person-

ally examined those of Europe, I have studied the specifications closely under which they are constructed, and have had gentlemen, and among them several engineers, who had inspected them, post me from time to time.

I think I can safely make the statement, without fear of contradiction, that properly treated long leaf yellow pine blocks, laid on Portland cement concrete foundation, make the best pavement known to engineers, and especially are they the ideal material with which to pave bridges or viaducts.

For such bridges as those at Joplin and Omaha (light steel structures), I would recommend the following:

The blocks to be made of long leaf yellow pine—3 inches in width by 3½ inches in depth (with the grain), and 8 inches long (the width and depth should never be the same in order to avoid laying them wrong side up), treated with from 18 to 20 pounds of the heavy oil of creosote to the cubic foot of timber—specific gravity of the oil about 1.075.

The flooring to consist of 3-inch ship-lap flooring, creosoted with 12 pounds of creosote oil to the cubic foot, laid diagonally and closely spiked. All uneven surface should be adzed smooth and swept broom clean, then pour thereon asphalt cement, fluxed as already specified, at 300 degrees Fahr., and spread with a rubber-lip scrape, or squeegee, and into this while still hot, set the creosoted blocks, grain up; next to each curb place a strip 1 or 1½ inches by 6 inches temporarily to form expansion joints; adjacent and parallel thereto, lay a row of blocks. All other blocks in the pavement to be laid at right angle to the axis of the bridge.

The width of the expansion joint to depend upon the width of roadway—one inch at each curb for a 30-foot driveway, 1½ inches for a 50-foot driveway.

The blocks should be closely laid sidewise, and the lines kept straight, but a space of 1-16 of an inch should be left between the ends of the blocks.

All blocks should be manufactured rectangular and of exact depth; a variation of 1-16 of an inch could be allowed as to width.

When the blocks have all been laid, the surface should be swept broom clean and a close inspection made to see that no inferior block has been left in, or a block turned wrong side up. There should be no closure permitted less than four inches in length, and all laps at least two inches.

After the inspection, remove the strips at the curbs and pour over the surface asphalt cement—fluxed as specified, and with a rubber-lip scrape work it back and forth until all cracks and interstices have been filled. The asphalt cement should have a temperature of 300 degrees Fahr., when poured on the surface, in order that every crack may be filled. While hot, spread a layer of pebbles, also heated up to 300 degrees Fahr., about ¼ inch thick, over the entire surface and thoroughly roll with an 8-ton tandem roller. Twenty-four (24) hours thereafter, the same can be open to travel.

If street car tracks are on the bridge, fill under the ball or flange of the rails with Portland cement mortar, made of one part cement and three parts screened sand, making side of same perpendicular, and when dry paint with hot asphalt cement: Against it place a piece of timber 2 inches thick, with width equal to depth of creosoted blocks used, made of rift-sawed lumber and creosoted with at least 12 pounds of creosote to the cubic foot of timber, top of same to be flush with top of rails, to be fastened to floor timber with 6-inch lag-screws.

A bridge so paved will last certainly twenty years, and the pavement will not buckle.

H. L. Collier,
Consulting Engineer, Atlanta, Ga.

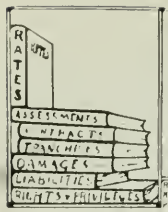
The full description of the contraction of wooden block pavements under cold will be found in Municipal Engineering, vol. xxii, p. 154. In brief, after 20 days of cold weather a redwood block street, untreated, and a yellow pine street, blocks merely dipped in creosote, both showed transverse cracks at intervals of 25 to 30 feet, averaging a shrinkage of about 1 inch to 30 to 35 feet of pavement. On a street with blocks laid in diagonal lines cracks were closer together and not so open and extended approximately across the street, following joints in zigzags and occasionally running through a block. Longitudinal cracks untimately developed in the streets with rows perpendicular to the curb but not in those with diagonal rows. Loud reports were heard on the streets on cold nights as the cracks were forming.

This was unquestionably a case of contraction during a continued very nearly dry cold spell, which the writer has never observed before or since, no other such "spell of weather" having come under his observation.

More or less dirt got into the open cracks and when the thaw came with a warm rain the blocks swelled by absorbing moisture until large areas of the street surfaces became merely piles of blocks giving no indication that they had ever been laid in place.

The writer sees no reason why, given similar conditions as to humidity and consequent absorption of water, wooden blocks should not expand and contract with the heat and cold. Is the observed expansion under cold not due to absorption of water, just as contraction under heat is usually due to the evaporation of water from the blocks?

Creosoted blocks differ from those observed, by more nearly complete filling of the pores in the wood with a permanent filler, and this difference must be remembered in attempting to draw conclusions from them. [Editor.]



MUNICIPAL MATTERS IN COURT

Higher Courts—Contract for Indefinite Period—Property Control by State Regulations.

Decisions of the Higher Courts of Interest to Municipalities.

Property Owners Assent Necessary to Install Drains.—The assent of property owners to have water drained across their land by ditches dug by a village gave the village no right to continue such drains, after the owners objected to their continuance, so that their continuance could be enjoined; the village not having the right to maintain the ditch without the property owners consent. Hart v. Village of Adams et al (N. Y.), 125 N. Y. S. 652.

Partially Invalid Assessment.—Unless the whole assessment for the purpose of grading, draining, curbing, and paving a street is void, a case for injunction cannot be maintained, for he who seeks equity must do equity. If any part of the assessment against the owners land is valid, he cannot have an injunction unless he has paid or offered to pay such part as is valid. Jenkins v. Oklahoma City et al (Okla.) 111 p. 941.

Future Water Rentals May Exceed Statutory Limit of Indebtedness.—A municipality may legally contract for the future supply of water at an annual rental, though the aggregate of the rentals will exceed the statutory limitation of indebtedness, being a contract for future indebtedness to be incurred, provided the contracting party perform the agreement out of which the debt may arise, not being a "debt" within the meaning of the limitation. City of Joseph v. Joseph Water Works Co. (Ore.), 111 P.864.

City Not Responsible for Contractor's Indebtedness.—One furnishing material to a municipal water works contractor has no right of action against the city on account of his claim. E. T. Dupont De Nemours Powder Co. v. Culgin-Pace Contracting Co. et al (Mass.), 92 N. E. 10231.

Utilities Corporation May Not Discriminate in Supplying Service.—A corporation organized to supply a municipality with electric light, steam, and hot water heat was given a franchise to use the streets for its pipes, etc. This corporation later imposed a condition that no one who did not use the electricity could have steam. *Held*, an unreasonable and unwarranted condition; it being the privilege of its patrons to determine what commodities they would purchase. Seaton Mountain Electric Light, Heat & Power Co. et al v. Idaho Springs Inv. Co. et al (Colo.), 111 P. 834.

City Not Liable for Small Defect in Sidewalk.—In installing its water system, defendant village set an iron pipe shut-off water box in a brick sidewalk. The cap on top of the box, which was less than a foot from the coping, was 3¾ inches in diameter, and projected ¾ of an inch above the sidewalk. On one side of the box, a brick had settled ¾ of an inch, making the cap project on that side 1½ inches above the surface. *Held*, that the defect was so slight that the village was not liable for injuries caused by catching plaintiff's foot under the cap on the side the brick had settled. Powers v. Village of Mechanicsville (N. Y.), 125 N. Y. 801.

Power of the Board of Works.—A party seeking to enjoin the city authorities from constructing a sewer so as to create a lien on land, on the ground that the board of public works cannot lawfully decide that the improvement will be a benefit to property affected thereby, when all the evidence is that it will be of no benefit, and that the board belongs to the administrative department of the city government, so that its acts can be inquired into by a court to determine whether certain facts exist which call for the exercise of discretion of the board, collaterally attacks the proceedings of the board in constructing the sewer, and the presumption must be indulged in favor of the acts of the board. Johnson v. City of Indianapolis (Ind.), 93 N. E. 17.

Liability for Excessive Part Payment on Contract Work.—Material men sued a city to obtain payment for materials furnished to the contractor, who threw up the job before completion, and the city admitted its readiness to pay a specified amount to whomsoever it might be due, and asked that the various claimants litigate their rights. *Held*, that one whose claim was for materials furnished for extra work could not complain on appeal that the amount established as due from the city was too small by the value of the extra work done, where, if that amount were added to the city's admitted liability, there would not even then be enough to satisfy the claims prior to that of the objector. National Iron Works v. City of Monroe et al (La.), 53 S. 563.

Contractors' Liability Ceases with Acceptance of Work.—After an improvement district had accepted the work of a contractor in constructing a concrete walk over a branch 5 feet deep and 12 feet wide according to specifications, a contractor could not be held liable to a person for injuries because of the absence of any light or railing on the walk, the rule being that after the contractor's work has been accepted by the proprietor, the contractor incurs no further liability to third parties by reason of the condition of the work, the responsibility for maintaining or using it in its defective condition being shifted to the proprietor. Memphis Asphalt & Paving Co. v. Fleming (Ark.), 132 S. 222.

Value of Improvement May Not be Credited Against Damages.—In an action against a city for constructing an alleyway that caused water to back up on plaintiff's land, the city cannot show, to mitigate damages, that the alley renders the property more convenient and valuable. Ewing et ux v. City of Louisville (Ky.), 131 S. W. 1016.

Notice Required Concerning Change in Specifications.—After the advertisement for bids for paving a street with brick of a specified minimum size was made, but before any bids were accepted, on the day preceding the letting of the contract, the specifications for the contracts were changed by reducing the minimum size of the brick and the contract then awarded on the new basis. The other bidders than the successful one had no notice of this change. Certain parts of the work were not done according to the contract and the board of aldermen orally released the contractor from compliance. *Held*, that an assessment based on that work and contract was void, being in violation of an act requiring contracts for street improvements to be let to the lowest and best bidder upon plans and specifications furnished, etc., and with not less than one week's advertisement. City of Marysville, to Use of Citizens' Nat'l. Bank of Des Moines, Iowa, v. Lippman et al. (Mo.), 132 S. W. 47.

Property Owner Responsible for Water Appurtenances on His Property.—Where an abutting property owner installed the service pipes, stop boxes, and other appliances constituting the conduit from a street water main to his premises, such appliances belonged to him as appurtenant to his realty. Fisher v. St. Joseph Water Co. (Mo.), 132 S. W. 288.

New Jersey Cities Must Submit Water Supply Plans to State Boards.—Where a borough proposes to construct water works and issue bonds therefor, and the case is one to which the act of 1909 requiring the approval of the State Board of Health, and the act of 1910, requiring the approval of the State Water Supply Commission, are applicable, the approval of these boards must be secured in advance of the election to authorize the construction of the works and the issue of the bonds to pay therefor.—Wilson et al. v. Mayor and Council of Borough of Collingwood (N. J.), 80 Atl. 335.

Valid Contract for Indefinite Period Cannot Be Made by City Council.

The Supreme Court of Georgia has rendered a decision in the case of a contract made by the city of Moultrie with G. A. Hoskan for indefinite supply of water and sewer service in return for right-of-way for sewer, which has direct bearing upon the question of rights under perpetual franchises which so often arises. In the opinion accompanying the decision the court proceeds as follows:

One of the grounds urged by counsel was that the contract was void for the reason there was no limitation fixed as to the time of its continuance. In our opinion this point was well taken. There has been, before various courts, the question of the legal power of a municipal corporation to make a contract or to grant a license extending over a period beyond the official term of the body granting the privilege or the license. The decisions on the question are not uniform. All legislative bodies are limited in their legal capacity in such a manner as not to deprive succeeding bodies of the right to deal with matters involving the same questions as they may arise from time to time in the future, and as the then present exigencies may require. The weight of authority sustains the doctrine that a municipal corporation may make a valid contract to continue for a reasonable time beyond the official term of the officers entering into the contract for the municipality. 3 Abbott's Municipal Corporations, Sec. 904. We have found no case, however, that would tend to support a contract made by a city council in behalf of the municipality to furnish water indefinitely to one of its citizens, in consideration of his permitting it to lay a sewer through his land. Succeeding councils would necessarily have the power, we think, to change the water rates from time to time as circumstances might require or justify, in order to obtain sufficient revenue to maintain its water works system on the one hand and, on the other, in order to serve all its patrons at reasonable rates and on equal terms. To allow one council to legally bind the city by a contract of the kind here in question might so tie the hands of its successors as to result in great injury to the municipality and to the public. Trustees v. City of Jacksonville, 61 Ill. App. 199. In the case just cited it was held that a city could not bind itself by contract to furnish water for a period of years at a fixed rate. "Powers are conferred upon municipal corporations for public purposes: and as their legislative powers cannot * * * be delegated, so they cannot be bargained or bartered away. Such corporations may make authorized contracts, but they have no pow-

er, as a party, to make contracts or pass by-laws which shall cede away, control or embarrass their legislative or governmental powers, or which shall disable them from performing their public duties." 1 Dillon's Municipal Corporations (4th Ed.), Sec. 97. Our Civil Code of 1910 (Sec. 892) declares that "one council cannot by an ordinance bind itself or its successors so as to prevent free legislation in matters of municipal government." If this could not be done by an ordinance, of course it could not be done by a contract. Power in a municipality of making and changing, by ordinance, water rates from time to time, whenever necessary to protect the city in its revenues and to enable it to furnish to all on equal terms and at reasonable rates, is a legislative or governmental power, and therefore cannot be legally bargained or bartered away by one council, so as to forever deprive succeeding councils of the right to exercise it. See Tarver v. Mayor, etc., of Dalton, 134 Ga. 462, 67 S. E. 929, 29 L. R. A. (N. S.) 183.

The fact that the city has continuously since the execution of the contract, and solely by reason thereof, used the sewer laid through the land of the defendant in error, and is now deriving a benefit under the contract by the use of the sewer, will not amount to a ratification of the contract, or an estoppel upon the city so as to prevent it from contending that the contract was void. Town of Wadley v. Lancaster, 124 Ga. 354, 52 S. E. 335.

Power of State to Control Use of Property by Sanitary Regulations.

A recent decision of the Supreme Court of Vermont, if adopted by the courts in other States, will greatly increase the ability of sanitary authorities to control the use of property. The decision was made in an appeal from the assessment of a fine upon an owner of property on the shore of the pond from which Montpelier draws its water supply for bathing therein in violation of a valid order of the State Board of Health, made for the purpose of protecting the city's water supply. Following are some extracts from the opinion accompanying the decision:

Coming now to the more serious and important question in the case—the validity of the regulation—the position of the respondent is that it is utterly invalid and void, for to give effect to it would be to deprive him of his property without compensation and without due process, contrary to the guaranties of the organic law.

The respondent relies much upon People v. Hulbert, 131 Mich. 156, 91 N. W. 211, 64 L. R. A. 265, 100 Am. St. Rep. 588, a case in its facts surprisingly like the case in hand. There, as here, one was convicted of bathing in the waters of a pond or lake from which a city took its water supply. A statute made it a criminal offense to pollute such waters. The respondent stood as a riparian owner. The court held that as such owner he had a right to a reasonable use of the waters of the lake; that such use could not be taken away by the police power of the State. With the conclusion reached in that case we cannot agree. That a riparian owner has a right to the reasonable use of the water of such a pond, we agree; that this ordinarily carries the right to bathe and swim therein, we agree; that this right is a property right, we agree. This right is an incident to the ownership of the land. It is to be observed, however, that it is not primary, but incidental. The land is the principal; the water the incident. In other words, the water goes with the land, and not the land with the water. Avery v. Vt. Elec. Co., 75 Vt., at page 242, 54 Atl. 179, 59 L. R. A. 817, 98 Am. St. Rep. 818. Can it be said that it is always and under all circumstances a reasonable use of such waters to bathe therein? Reasonable use varies with circumstances. It depends, among other things, upon what use is made of the water by the lower owners, whose equal right must be respected. Lawrie v. Silsby, 82 Vt. 505, 74 Atl. 94. If bathing in a pond from which a city takes its water supply contaminates, or in circumstances reasonably to be apprehended may contaminate, such waters, thereby endangering the health of the community, can it then be said that the riparian owner is making a reasonable use of his incidental right? The answer must be negative.

Such use in such circumstances may be prohibited in a valid exercise of the police power. The owner's rights are not then "taken" in a constitutional sense; or, if this statement savors too much of refinement of reasoning, as some suggest, the "taking" is not such as the Constitution prohibits. The beneficial use of the property is curtailed in some measure, but all the other incidents of ownership are left unimpaired. The fact that this is a property right does not determine the question. There remains the question whether the promulgation and enforcement of the regulation is a legitimate exercise of the police power. For, as we suppose every one now agrees, the possession and enjoyment by the individual of all his rights, even that of liberty itself, are subject to such reasonable regulations and restraints as are essential to the preservation of the health, safety and welfare of the community. The proposition is well stated in Wood, Nuisances (3d Ed.), Sec. 1: "It is a part of the great social compact to which every person is a party—a fundamental and essential principle in every civilized community—that every person yields a portion of his right of absolute dominion and use of his own property in recognition of and obedience to the rights of others, so that others may also enjoy their property without unreasonable hurt or hindrance." It follows, then, that whenever any of the rights of the individual come into conflict

with those of the public which concern the interests named, the former must yield and the latter prevail.

The enforcement and protection of these paramount rights is the proper function of the police power. This power inheres in the governing body—the Legislature. There it abides, and with it of necessity goes a wide, though reasonable, discretion as to the necessity and manner of its application to particular conditions.

The power may lawfully be delegated to municipalities, to local or to state boards. Board of Health v. St. Johnsbury, 82 Vt. 276, 73 Atl. 581, 23 L. R. A. (N. S.) 766; Chicago v. Hotel Co., 248 Ill. 264, 93 N. E. 753; State v. Diamond Mills Paper Co., 63 N. J. Eq. 111, 51 Atl. 1019, affirmed 64 N. J. Eq. 793, 53 Atl. 1125; Rossberg v. State, 111 Md. 394, 74 Atl. 581, 134 Am. St. Rep. 626. And, when so delegated, the agency employed is clothed with power to act, as full and efficient as that possessed by the Legislature itself. From the fact that this power resides in the legislative branch of the government, it follows that it is for that department to determine, primarily, what measures are necessary and appropriate for the protection of the public morals, health or safety. Mugler v. Kansas, 123 U. S. 623, 8 Sup. Ct. 273, 31 L. Ed. 205.

But these measures in order to be lawful, must, in some reasonable degree, tend to the accomplishment of such result. People v. Murphy, 195 N. Y. 126, 88 N. E. 17, 21 L. R. A. (N. S.) 735; ex parte Quarg, 149 Cal. 79, 84 Pac. 766, 5 L. R. A. (N. S.) 183, 117 Am. St. Rep. 115. And therefore, in its last analysis, the question of the validity of such measures is one for the court. State v. Speyer, 67 Vt. 502, 32 Atl. 476, 29 L. R. A. 573, 48 Am. St. Rep. 832. But with the wisdom or expediency of such measures the court has nothing to do. If a law or a regulation (to use the language of Mr. Justice Harlan in Mugler v. Kansas) "has no real or substantial relation to those objects or is a palpable invasion of rights secured by the fundamental law, it is the duty of the courts to so adjudge, and thereby give effect to the Constitution." When the legislature, in a matter affecting the public health, adopts means and methods which are reasonable and appropriate, not oppressive or discriminatory, constitutional limitations are not transgressed. Lawrence v. Rutland R. R. Co., 80 Vt. 370, 67 Atl. 1091, 15 L. R. A (N. S.) 350; Board of Health v. St. Johnsbury, supra; Orient Ins. Co. v. Daggs, 172 U. S. 557, 19 Sup. Ct. 281, 43 L. Ed. 552. But, when the legislature or its delegate exceed these bounds, individual rights are invaded and the attempted regulations are void. State v. Speyer, 67 Vt. 5502, 32 Atl. 476, 29 L. R. A. 573, 48 Am. St. Rep. 832.

Regulations for the protection of the public health are looked upon with favor. State v. Aberdeen, 58 Wash. 562, 109 Pac. 379. Every reasonable presumption is made in favor of their validity, and "every intendment is indulged to sustain them." Cooley Const. Lim. 721. And the burden is on him who asserts their illegality. People v. Board of Health, 140 N. Y. 1, 35 N. E. 320, 23 L. R. A. 481, 37 Am. St. Rep. 522; Miles City v. Board of Health, 39 Mont. 405, 102 Pac. 696, 25 L. R. A. (N. S.) 589; Bonnett v. Vallier, 136 Wis. 193, 116 N. W. 885, 17 L. R. A. 486, 128 Am. St. Rep. 1061; Mugler v. Kansas, supra; Sinking Fund cases, 99 U. S. 718, 25 L. Ed. 501; State v. Moore, 104 N. C. 714, 10 S. E. 143, 17 Am. St. Rep. 696. This presumption attaches to each element essential to their validity. So their reasonableness is presumed. City of Butte v. Paltrovich, 30 Mont. 18, 75 Pac. 521, 104 Am. St. Rep. 698. We are aware that it is sometimes said that it must appear that the regulation tends in some degree to conserve the public interests. It was, in effect, so said in the course of the discussion in Horwich v. Walker-Gordon Laboratory Co., 205 Ill. 497, 68 N. E. 938, 98 Am. St. Rep. 254, and in Frank L. Fisher Co. v. Woods, 187 N. Y. 90, 79 N. E. 836, 12 L. R. A. (N. S.) 707. But a more accurate statement of the rule is found in People v. Smith, 108 Mich. 527, 66 N. W. 382, 32 L. R. A. 853, 62 Am. St. Rep. 715, wherein it is said that if the legislature has enacted a regulation for the benefit of the public or some general class thereof, and the regulation is assailed as an unnecessary or unreasonable interference with property rights or with the right to contract, the presumption is in favor of the validity of the legislative action, and unless some plain provision of the Constitution has been violated, or it can be said that the regulation is not within the rule of necessity in view of facts of which judicial notice may be taken, the statute must be sustained; and in State v. Holcomb, 68 Iowa 107, 26 N. W. 33, 56 Am. Rep. 853, where it is said that, before an ordinance or regulation of a board of health can be said to be unreasonable, it should clearly so appear; and in Rochester v. Macauley-Fien Milling Co., 199 N. Y. 207, 92 N. E. 641, where a smoke ordinance was under consideration, and the court said: "The common council is thus to judge as to what ordinances it will pass for the safety and welfare of the inhabitants of the city and the protection and security of their property, and, unless an ordinance passed by it is wholly arbitrary and unreasonable, it should be upheld. The necessity and advisability of the ordinance are for the legislative power to determine. The presumption is in favor of the ordinance." Such is the rule of this court, for it was said in Board of Health v. St. Johnsbury, 82 Vt. 276, 73 Atl. 581, 23 L. R. A. (N. S.) 766, in effect, that unless a statute was palpably in conflict with the Constitution, state or federal, or it could be confidently asserted that the means prescribed by it had no just relation to the protection of the public health, it must be sustained.

FIRE AND WATER

Comparative Test of Fire Steamers and Automobile Fire Engines.

In the test between the old steamer of the Atlanta, Ga., department and the auto fire engine Friday afternoon, July 21, 1911, water was pumped from the basin on Court Square. Both steamers pumped streams as high as the top of the First National Bank building, but when the word "start" was given the auto engine had its streams going first and maintained regularity throughout the test, while the stream of the city's engine fluctuated, at times throwing very high and again falling back, reaching only a medium height.

At one time during the afternoon the power of the two steamers was combined, both pumping water through separate hose but connected together through the same nozzle. This stream of the combined engines was thrown much higher than the flagpole on top of the First National Bank building.

As a closing test of the afternoon both pieces of apparatus were sent to the Five Points fire station and a run was made from there to Court Square, where each engine coupled to a hydrant and started a stream. Both left the station at the same second, but the auto engine reached the square two minutes ahead of the old steamer and had a stream of water shooting into the air five minutes ahead of the city's steamer, showing a saving in time of seven minutes. Seven minutes means much in case of a fire.

The auto engine made the run from Five Points station in thirty seconds' time and had a stream going in a total of fifty seconds after leaving the station.

After the test at the square Mr. Davidson took the auto engine out on Montgomery county's fine roads and made a fourteen-mile run for the benefit o'f one of the commissioners and several newspaper men.

Automobile Fire Apparatus.

The popularity of automobile fire apparatus is rapidly increasing. The city of Macon, Ga., spent about $53,000 last year in improving its fire department, including two new fire stations, about $5,000 worth of hose and four automobiles, two of them being pumping engines, two chemical engines and one a runabout for the chief of the department. The department will probably spend $20,000 during the coming year for additional automobile apparatus and so displace all its horses, having an automobile even for hauling coal.

The Atlanta, Ga., fire department, now numbering 200 men, is displacing horses by automobiles. The most important new addition of this class is a combined automobile pumping engine, chemical and hose wagon, installed in the new No. 12 engine house.

Richmond, Va., is agitating the purchase of automobile apparatus, even though the first cost, according to their estimates, is $10,000 for an automobile engine and about $6,500 for three horses, harness and engine.

The automobile chemical engine at Nutley, N. J., has been beaten to two recent small fires by a horse-drawn hose wagon, the reason for the occurrence not appearing.

New York City has spent a year in testing ten automobile fire trucks and is preparing to spend a million dollars in replacing horse-drawn apparatus within a year or so. About 150 hose carts, hook and ladder outfits and engines are included in the first plans, and if they meet expectations the changes will continue.

Woonsocket, R. I., is agitating the construction of two or three new fire stations and automobile apparatus. The objectors to the expenditure claim that the automobiles will have difficulty in passing through the streets when deeply covered with snow, the street cleaning department not attempting to clean it off.

Pittsburgh, Pa., officials will investigate motor apparatus at the Milwaukee convention of fire chiefs, September 19.

Saginaw, Mich., is discussing the need of fire engines following a temporary disablement of its large water works pump by the breakage of a cylinder head. One automobile fire engine had been ordered, but not yet delivered at the time of the break, and the city possesses but two horse-drawn engines. The general demand is now for five new fire engines. The water commissioners recommended last year that two be purchased, but one of which was allowed. That body apparently makes the only demand for a new water works pumping engine, which is one of the most important needs.

Aurora, Ill., received twelve bids for a motor truck, ranging from $3,000 to $5,244.

Selecting New York's Fire Chief.

The examination for the post of fire chief in New York City, which took place in July, is said to be the most remarkable and im-

portant civil service test ever known. It was a straight competitive trial, at which extraordinary care was taken to rate each paper on its merits. The handwriting of the candidates was never seen by the examiners, for each candidate's papers was known only by a number, and the papers were transcribed by three stenographers in a locked room, after which the original papers were locked in a vault.

It was a severe and technically thorough examination, due to the many new problems presented by the growth of the city—higher buildings, fire-fighting with chemicals, variation of water pressure and dealing with unexpected emergencies. The fire chief must understand how to handle engineering and strategical difficulties. Deputy Chief John Kenlon was the successful candidate.

The Chara: A Water-Purifying Plant.

BY JAMES SCOTT.

While there are many species of plants and algæ the growth of which in water-supply reservoirs is to be discouraged, there is at any rate one group which deserves to be propagated on account of its effects in improving the quality of the water in which it grows. This group is that of the *characcae,* the most highly developed of green algæ. The chara is easily reared and is exceptionably fertile, and the writer believes that if properly managed it would be a very valuable means of purifying water supplies. In cases where it has been tried and has seemed to fail, it will often be found that other plants have been allowed to thwart its action. It is not reasonable to expect a small patch of the plant to fulfil its functions properly if overwhelmed by antagonists. When the plant is dead it should be removed. Among those who have definitely recommended chara as a purifying agent for reservoirs is Dr. Allan (see "Aids to Sanitary Science," p. 13).

Chara is a surface-growing plant, except in certain circumstances. It has the power of oxygenating the water and neutralizing the effects of anærobic bacteria and bacilli. Sometimes it is sunk partly below the surface owing to the weight of its fruiting organs. In any case, after it has grown undisturbed for a length of time it will have formed masses of vivid green interlacing filaments. Tiny crystals of calcic carbonate are dispersed over its surface, and these possibly play some part in its purifying action. It is found in quiet back-waters and still ponds, or in the slack waters of sluggish streams. Strong or even moderate currents disintegrate the delicate stems and prevent the carrying out of the curious and interesting fruiting process. The commonest species is *chara fragilis.* The plant until mature consists of little more than strings of ribbed green filaments, divided across, and having circlets of leaves —which occasionally become roots—springing from nodes. These sets of leaves are sometimes widely expanded, like rosettes, and at other times close up tightly in line with the main stems. From each of these leaves there emerge, upwards, secondary projections; and at the bases of the latter occur during the season of reproduction tiny red balls (about the size of small pinheads), that may be mistaken for seeds. We must magnify these balls, of which there are dozens within a few inches space, before we can discover their true formation. Upon doing this we find that there are, in practically every instance, two distinct shapes of these objects, and that they are arranged in couples.

Isolating two of these peculiar organs for examination, we see that the lower one is fairly globular, while the upper one is elongated and boldly ribbed.

The first is called *globule,* and the upper one a *nucule.* The globule consists of a few triangular, concave plates ribbed from the centre outwards, and these fit together during the early stages as a ball, exhibiting no definite traces of division. As the plant ripens these plates separate, and each one discloses on its inner side about a dozen transparent curly filaments springing from the centre of the plate. From each filament there ultimately appears a number of spermatozoo-like germs, called *antherozoids,* every one of which is provided with a long *cilium* that lashes the surrounding water, and enables it to "swim" in the merium after it has escaped from the filament. The latter, by this time, has lost its segmenting partitions, and soon shrivels beyond recognition.

The filaments are all directed inwards, and twine together before the globule splits and shakes them outside it. The plates are really composed of several blades united by their edges. Each blade is the base of a filament.

So far we have dealt only with the "male" section of the plant. The "female" portion is comprised in the upper and larger vessel, known as the *nucule.* This is closed at its summit by a set of five valves, and contains a number of loose adherent cells comparable with the valves, or embryo seeds, of most higher plants. When ripe, the nucule opens its valves widely, and the mass of cells is cast forth as a single seed to propagate another plant.

All this elaboration is induced for the following purposes: The *globule* separates its plates and allows its filaments to twirl about in the water between the interstices. The *antherozoids* are thereby released, and find their way into the open urns, or *nucules,* wherein they fertilize the female cells, or *sporangia.*—*The Surveyor.*

Consumption of Water in Bangor Fire.

Investigation made recently at the Bangor pumping station revealed the fact that from Sunday morning at 9 o'clock until Thursday morning at the same hour, during the Bangor fire, 25,866,000 gallons of Penobscot river water had been pumped through Bangor mains to supply the firemen and the broken pipes in the burned district, which poured water out constantly; and the ordinary needs.

The amount pumped from 9 o'clock Sunday morning until 9 Monday morning, was 6,381,000 gallons; from Monday to Tuesday morning, 7,150,000 gallons; Tuesday to Wednesday, 6,256,000 gallons, Wednesday to Thursday, 6,079,000, making a total of 25,866,000 gallons pumped during the four days. Ordinarily the output would have been 3,750,000 gallons each day or a total of 15,000,000 for four days so the excess water sent was over 10,000,000 gallons.

Many people in the burned district, when they left their threatened homes, left the faucets on at full tilt, hoping thereby to partially save their homes. This attempt was futile, of course, and only resulted in a weakening of the water supply.

Disposal of Surplus Water Supply of Los Angeles.

The new Owens river supply of the city of Los Angeles is some 400 second-feet greater than the city will need, and a judicious distribution of this water may be made to pay a large portion of the cost of the new aqueduct and its connected works. A board of engineers, composed of Wm. Mulholland, chief engineer of the aqueduct; J. H. Quinton, of the U. S. Reclamation Service; Homer Hamlin and W. H. Code, has been considering the method of distribution of this surplus and made a report on July 3, recommending the amount to be distributed and the districts to which it should be awarded. There are ten such districts, several of them with subdivisions, which are to receive from 7 to 80 second-feet each, on the assumption that 7.5 acres can be supplied with water for municipal purposes or for irrigation by one miner's inch of water, there being 50 minter's inches in a second-foot of water. The major portion of this water is allotted to districts well up the valleys served, so that the seepage, or the flow of water from the ground after it has been applied in irrigation, can be again used is irrigating lands farther down.

The report shows that the cost of constructing the works for distributing this water over the various districts will be from $20 an acre up, averaging about $40 for the whole area, in addition to the cost of the aqueduct to supply the water to these distribution systems. Three districts will have an additional expense because they are so high that they must take their water above the water power plant which Los Angeles is installing along the line. The capitalized value of this power must be paid by these districts, being $15 an acre for two of them and $50 for a third.

The cost of the water to be supplied from the aqueduct is not fixed in the report. This must be left to determination when the cost of the aqueduct and of operating and maintaining it and the works connected with it are better known than is now possible. The recommendation is made that the charge be uniform for all the districts supplied. It is suggested that the Riverside district pays from $125 to $200 an acre for the right to use water with an additional annual charge of $6 to $9 an acre, so that, while the cost as computed may seem large, it is less than is paid by districts with developed water supplies.

The right of the city to the flow in the Los Angeles river is retained and this water will also be utilized.

Increased Water Supply for Pittsburg.

The city of Pittsburg has recently awarded contracts for the equipment for the new Aspinwall pumping station, which, when completed, will add 100,000,000 gallons per day to the water supply. The new station is to be erected at Aspinwall, near the site of the filtration plant. This station will eventually contain five 20,000,000-gallon pumping engines, but only four of them will be installed at the present time.

The contract for the entire pumping equipment has been awarded to Allis-Chalmers Company for approximately $300,000. At one end of the station will be placed two complete new triple expansion pumping engines with steam cylinders 32 inches, 60 inches and 94 inches in diameter by 66 inches piston stroke. The water ends are designed to deliver 20,000,000 gallons of water each 24 hours against a head of 275 feet when the steam ends receive steam at 160 pounds pressure and 100 degrees F. superheat.

In connection with these units it is interesting to note that the duty guarantees are the highest ever made. The guarantee calls for a duty of 195,000,000 foot-pounds per 1,000 pounds of steam.

At the opposite end of the building two new water ends, similar to those of the units already mentioned, will be placed. The steam ends of these units will be the Holly engines now in the Montrose station, which are to be dismantled and re-erected on the new water ends. There will remain space in the center of the station for a fifth unit which can be installed when needed.

The new pumping engines will take their supply from a suction line running under the boiler room and parallel to the engines and will discharge into the Montrose rising main which supplies the Troy Hill reservoir. At some future time the water from this station will be delivered to the proposed new Cannage Hill reservoir.

Improvements of Boston Fire Department.

The finance commission of Boston, Mass., has made a careful investigation of the present condition of the fire department and has made a report showing the ways in which its service can be improved.

A large factor in reducing the efficiency of the department is the ordinance giving firemen one day off in five, a two weeks' vacation and four hours a day for meals. This results in shortage in men for nearly half of each day, which may amount to two-thirds the nominal company force. The commission recommends that this be remedied by repealing the ordinance and leaving the control of the men with the fire chief, where it belongs, and by adding 50 men to the force.

To hasten the arrival of fire apparatus at fires, especially in outlying districts, the commission recommends the replacement of horse-drawn apparatus by automobiles as follows: Fifteen runabouts for use by district chiefs and superintendents of repairs and fire alarm; 3 combination wagons to take places of wrecking wagon and two supply wagons of fire alarm and repair divisions, which can also serve as auxiliary hose wagons; 10 chemical hose wagons to displace horse-drawn chemicals, and 13 of capacity for the high-pressure system which has been ordered, to displace horse-drawn hose wagons; 4 ladder trucks to displace light horse-drawn trucks in outlying districts and 2 to displace chemical engines. This apparatus will cost $189,250 or $166,035 when allowance is made for exchange of the old apparatus. The cost of maintenance of the new apparatus may be equal to or even greater than the maintenance of the horse-drawn apparatus, but the twelve or fifteen-mile-an-hour speed of horses can be nearly doubled, long distances can be covered at full speed, apparatus gets back to quarters more quickly and the services of the automobile driver are available at fires, thus increasing the available fire-fighting force by the 47 men so employed. The commission therefore recommends the appropriation of $175,000 for the new apparatus.

The fire limits of the city cover only about one-tenth the area of the city, a proportion much less than in any other large city. The extension of these limits and stricter building regulations are strongly recommended.

A Metropolitan Fire District for Boston.

One of the lessons of the great Chelsea, Mass., fire was the need of the same unity of operation of the fire departments of Bostos and its adjoining cities and towns which there is in the supply of water. A new plan is being worked out by which the fire departments of all these adjacent municipalities will be treated as one in laying out the scheme for companies called to fires, especially for second, third and general alarms, whereby the various departments will be worked into a complete whole, each fire being under the management of the district chief and his force, having the assistance of neighboring companies according to the established schedule.

With the exception of Boston none of the cities and towns which participate in the "mutual aid" can afford to maintain apparatus and men of sufficient strength to handle more than an ordinary blaze.

Thus when a large fire ensues within their borders they are compelled to call for outside help, and therefore the plan works both ways. While being a unit in the "mutual aid" and moving into Boston on general alarms and in many cases on her borders responding to "firsts," each is likewise provided with concentrated moves from the Hub on the part of the city's apparatus.

In the following cities and towns which border on Boston and comprise the "mutual aid" the number of engine companies are: Cambridge, 8; Somerville, 5; Quincy, 2; Milton, 1; Hyde Park, 1; Dedham, 1; Newton, 1; Brookline, 2; Watertown, 2; Everett, 2; Chelsea, 2. Every one of these companies has been provided with a set of running cards which inform them where they move on alarms that are adjacent to their territory or when a general is sounded from Boston.

Under the card system the whole area centering in Boston proper is divided up into nine fire districts instead of three as heretofore.

In the event of a general alarm in Chelsea, under the present arrangement, 20 engines will go to Chelsea and about 55 engines will remain to respond to future calls. Every section of the great metropolitan area will be well protected, Cambridge and Somerville moving into Somerville and Charlestown respectively, and then there will be a general movement northward on the part of the Boston department to fill in the gaps left by the departure of engines for East Boston and Chelsea.

There will be one Newton engine in Brighton and another in Brookline, while Brookline will go over the Boston line into Longwood. There is a Waltham engine in Newton and the whole department will be on the look out for the next move.

Sixty Cent Gas Company Stock at a Premium.

The Citizens' Gas Company of Indianapolis, which is paying dividends with a partial load and a price of 60 cents a thousand, recently sold $50,000 of stock to provide for increases in plant. The company's charter requires that stock shall be sold at auction. After a lively contest with brokers, S. J. Ward, a "farmer from Bridgeport," secured the entire issue at $26.82 per $25 share, which is a premium of 7.28 per cent. The company is paying 6 per cent. dividends.

ROADS AND PAVEMENTS

State Highways.

Governor Johnson of California has selected as the three members of the State Highway Consulting Board two civil engineers, Burton A. Towne of Lodi and N. D. Darlington of Los Angeles, and a good roads enthusiast, Charles D. Blaney, of Santa Clara county, who will advise with the State Engineer and the State Highway Engineer regarding the spending of the $18,000,000 for highways for which the issue of bonds has been authorized.

The Sacramento - Solano - Napa - Sonoma Good Roads Association has been formed to promote the construction of a road from Sacramento through Rio Vista, Fairfield, Suisun and Napa to Santa Rosa under the new California road appropriation. S. Glen Andrus of Sacramento is the president of the association.

A sea level road from Ventura river to Rincon creek will let an automobile road from San Francisco into Los Angeles, and is being pushed in Los Angeles, Santa Barbara and Ventura county, the cost of reducing the grades being very heavy.

Convict labor is used successfully in Colorado. It is now in use on the 42 miles of road from Colorado Springs to Canyon City.

Minnesota recently passed a law providing for good roads construction under the State Highway Commissioner, the State paying one-half, the county one-fourth and the property owners one-fourth of the cost, the payments being spread over ten years. The northern section of the State is agitating four main roads connecting Duluth with St. Vincent, Moorhead and the twin cities of Minneapolis and St. Paul, and the latter with International Falls. The Northern Minnesota Development Association has been formed to promote the undertaking and has already held several meetings at Duluth, St. Paul, Bemidji and Brainerd, which have aroused much interest in the project.

Missouri has entered on a cross-state highway campaign and has the enthusiastic support of the Governor. The central route has been selected for the first road, after an inspection of three proposed lines. It runs from St. Louis to Kansas City, north of the Missouri river to Glasgow, where it crosses to the south side.

The new State Highway Commission of New Jersey has organized with Governor Woodrow Wilson as president and State Road Commissioner Edwin A. Stevens as secretary. The other members are Ernest R. Ackerman, president of the Senate, and Edward Kenny, Speaker of the House. The larger work of the commission will include the completion of the ocean boulevard and the boulevard on the east side of the Delaware river.

The new State Highway Board of New York has organized, its membership consisting of the State Engineer, John A. Bensel; the Superintendent of Public Works, W. T. Treman, and the State Superintendent of Highways, W. H. Catlin. About $14,000,000 were appropriated by the recent legislature to specially named roads in sums ranging from $60,000 to $1,500,000, five of the appropriations exceeding $1,000,000 each. It is reported that but $10,000,000 of the authorized $50,000,000 bond issue remains unappropriated.

The new Highway Commissioner of Pennsylvania, E. M. Bigelow, of Pittsburg, has begun his official life by a very active canvass of the situation and agitation for the construction of a large number of state roads. Among them are one from Harrisburg to Gettysburg, one from Pittsburgh through Gettysburg to Philadelphia, the section of the old National road through the State, one from Pittsburgh to Bedford, and one from Franklin into Clarion county, some brick roads in Venango county and many shorter roads extending through one or two counties. The new state highway law greatly changes the methods of procedure and will probably be followed by a bill in the next legislature authorizing a bond issue of $15,000,000.

The August convention of the South Carolina Good Roads Association at Spartansburg added to the enthusiasm in that State, which is making the best possible use of the small sums of money available in constructing the best roads obtainable with the materials at hand.

Tennessee is expending much energy upon the Memphis-to-Bristol highway, which is now an assured fact, and will be constructed as rapidly as the active canvass can secure the necessary funds. Some contest over the route has procured considerable appropriations for the road from county authorities, and private subscriptions are being made to aid in the construction through districts where public funds are not available The road will connect with a proposed road from Bristol to Washington through Virginia.

STREET · LIGHTING

Lighting Rates for Johnstown, N. Y.—Municipal Electric Light Plant, Holland, Mich. —British Gas Undertakings—Ornamental Street Lighting.

New Lighting Rates for Johnstown and Gloversville, N. Y.

Voluntary reductions in the electric lighting and power rates charged by the Fulton County Gas and Electric Company in the cities of Johnstown and Gloversville, to take effect September 1, so as to apply to bills rendered on and after October 1, 1911, are made in an application by that company to the public service commission.

The rates for lighting are reduced from 5, 8 and 10 cents per kilowatt hour to 4 and 9 cents per kilowatt hour, depending upon the amount used by the consumer. The minimum bill of this company for electric lighting remains at 50 cents per month. Electric power rates under the new schedule will be from 1½ to 9 cents per kilowatt hour, instead of 2½ to 10 cents per kilowatt hour under the existing rate schedules of this company.

Municipal Electric Light Plant at Holland, Mich.

Although Holland, Mich., charges a lower rate than any other city for electric light, the municipal electric light plant closes the fiscal year with a net income of $20,610.90, according to the annual report of Superintendent R. B. Champion of the Board of Public Works. Allowance is made in the operating expenses for interest, taxes and depreciation, which together aggregate $13,500.

According to the figures submitted the total cost of the plant since it has been in operation is $193,094.41, against which is charged a total of $76,076.17 depreciation. The total earnings during the seventeen years have been $464,682.89, which per $100 invested is $10.67. The gross income per consumer is $36.11; per capita of population, $6.24; gross income per $100 invested, $34; gross income per kilowatt hour generated, $.0337; ratio of expense, including interest and taxes, but not depreciation, 54.7 per cent.

The plant at present serves a population of 10,490. A flat rate of $50 per lamp per year is charged for street lighting.

British Gas Undertakings.

At the close of 1910 there were 1,255 gas undertakings in England, 263 in Scotland, 120 in Ireland, 135 in Australasia, 52 in Canada, and 15 in other British possessions. There were also 20 British companies owning gas works on the Continent and in other parts of the world. In England 1,029 gas works were owned by companies and 226 by local authorities; in Scotland 206 by companies and 57 by local authorities, and in Ireland 85 by companies and 35 by local authorities. The production of gas in England in 1910 was 176,493,540,000 cubic feet; in Scotland 16,993,455,000 cubic feet, and in Ireland 5,596,738,000 cubic feet, making a total of 199,083,733,000 cubic feet, compared with 194,464,593,000 cubic in 1909, distributed among 6,501,273 consumers. Of this total, municipal gas works supplied 68,193,721,000 cubic feet to 2,623,222 consumers, or 34.2 per cent. of the total quantity among 40.3 per cent of the consumers. Of the gas made in Scotland, 83.6 per cent. was made in municipal gas works, 29 in England, and 49.5 per cent. in Scotland, the last figure being mainly due to Belfast having a municipal supply.

The number of gas consumers in the United Kingdom increased in 1910 from 6,388,511 to 6,501,273, the new consumers largely using slot meters, the number of which advanced from 2,867,466 in 1909 to 3,084,503 in 1910. The number of gas cooking stoves in use in the United Kingdom in 1910 was 2,747,671 compared with 2,575,511 in 1909. There were 754,930 street gas lamps in the United Kingdom in 1910, of which nearly 82 per cent. were fitted with incandescent burners and mantles.

The price of gas to private consumers throughout the United Kingdom averaged in 1910 about 70 cents per 1,000 feet.

Ornamental Street Lighting.

Burlington, Iowa, has installed boulevard lights on one side of Main street and business men on other block are signing agreements so that the system will soon be extended to cover considerable additional frontage.

Keokuk, Iowa, is earnestly discussing the installation of ornamental lights on several blocks of Main street since Stone and Webster have acquired possession of the street railway and electric light plant and have increased their capacity to meet possible demands.

Helena, Mont., city council is planning boulevard lights on all the streets in the business district on a system which will cost the property owners benefited about $1 a front foot per year.

Peoria, Ill., is highly pleased with the effect of the cluster lights recently installed on Adams street through the efforts of the Merchants' Association.

The city council of New Castle, Pa., is putting a conduit in the concrete for the new pavement on Washington street to be ready for a system of cluster lights which is under discussion.

Knoxville, Tenn., is raising $12,000 by subscription for the installation of cluster lights on Gay street, the city to pay for the lighting service beginning with 1912.

Michigan boulevard, Chicago, will shortly have a double ornamental installation of cluster lights and handsome sanitary drinking fountains along Grant Park, which will add greatly to the beauty of that noted thoroughfare.

Denver, Colo., recently made a special exhibit of all its public and private lights for the benefit of staff photographers of eastern publications. The city is well provided with light for special occasions, but very properly economizes under every-day conditions by using only parts of its rather lavish supply. This was one of the first cities to install curb lights at frequent intervals and has instigated a remarkable growth of invention and improvement in this method of city advertising. Business men and corporations have been equally public-spirited, as well as open to the advertising value of lights as decorations.

The Los Angeles Franchise Ordinance.

The way will be paved for the municipal ownership of all public utilities sometime in the future, if the new franchise ordnance, as proposed by the board of public utilities, is adopted by the city council.

Municipal ownership is made possible by a provision that all franchises granted by the city shall be indeterminate within the 21-year limit prescribed by the charter. By the terms of the ordinance the city may acquire the physical property of the holder of the franchise any time within three years after the franchise has been granted and until six months before it expires.

That portion of the proposed ordinance relating to the method of acquiring the property of a corporation reads as follows:

Every ordinance granting any franchise, permit or privilege mentioned in section 2 of this ordinance shall reserve to the city the absolute right to purchase and take over the entire plant, property, business or system of such person, firm or corporation within said city, held, owned, operated or managed under or by virtue of such franchise, permit or privilege, with all the renewals, repairs, extensions and additions thereto, free and clear of all limitations, restrictions, liens or incumbrances of whatever nature, at any time after three years from the date of such franchise, permit or privilege, upon payment by the said city to the person, firm or corporation owning such plant, property, business or system under such franchise, permit or privilege of the full and fair value of such plant, property, business or system; provided, that notice from the city of its intention to purchase hereunder shall be made in writing and delivered to the person, firm or corporation enjoying and exercising such franchise, permit or privilege at least six months and not more than three years prior to the date upon which the said city proposes to exercise its right of purchase.

New Electric Conduit Systems.

The Penn Central Light Company, Altoona, Pa., will shortly complete a system of conduits in the business district, costing $300,000.

The Citizens' Light and Power Company, Sacramento, Cal., will spend $1,000,000 in wiring the city for electric light and power, including an underground conduit system.

The Johns-Manville Building.

The Johns-Manville building is the new twelve-story office building at Forty-first street and Madison avenue, New York, erected solely for the offices of the H. W. Johns-Manville Co. It is distinctive in architecture, as it is in purpose, is architecturally treated on all four sides, and an ornament to an important section of the city.

Each floor has an area of 2,500 square feet, or a total, including basement, of 34,500 square feet. A very large part of the equipment of the building is manufactured by the company, including asbestos roofing, asbestos plaster, linolite system of lighting, conduit for wiring, flashometers, sanitor seats, electrical accessories, waterproofing, hair insulator, asbestos wood, fire extinguishers, asbesto-sponge felted, asbestocel pipe coverings, etc.

All the offices, factories and branches of the company, together occupy about sixty-one acres of space, so that the three-fourths acre in the home office building and store is not out of proportion. There are 5,000 employes, including 406 traveling salesmen, but not including the European forces.

CURRENT · INFORMATION

Report on Railroad Electrification in St. Louis.

A report on the electrification of railroads in St. Louis has recently been prepared by the Civic League of that city. This report deals extensively with the terminal electrification work in New York and as proposed in Boston, and draws a comparison between the electrification problem in New York and in St. Louis, Chicago and Boston.

The chief difference between the New York situation on the one hand and that in Chicago, Boston and St. Louis on the other, is that while electrification was forced in New York by the existence of the tunnels, no such reason exists in the other three cities. If the Boston terminals should be electrified, it will be brought about largely because of a proposed tunnel to connect the north and south stations. The arguments advanced in favor of electrification are based almost entirely upon the freedom from smoke that would come with it and the greater comfort and convenience of the traveling public.

In St. Louis there is a comparatively light suburban travel and the saving brought about by the extended electrical zone would not be sufficient to justify consideration at the present time. The prime factor in the need of electrification at the present time is the abatement of the smoke nuisance, and this end would be accompanied by electrification within the city limits.

Inasmuch as the abatement of the smoke nuisance is the chief reason for electrification of the St. Louis terminals, it follows that such electrification must necessarily be complete; that is, it must provide for both freight and passenger traffic.

It is generally conceded that electrification is the only complete solution of the problem of eliminating locomotive smoke, but it is nevertheless a fact that fuel-burning locomotives may be so handled as to considerably reduce the volume of smoke and cinders ordinarily emitted, even when the fuel is bituminous coal. Experiments with different types of mechanical stokers and other smoke-prevention devices indicate that thus far the most effective smoke-preventer is an intelligent fireman. Several of the railroads have instituted a systematic campaign for the education of the firemen, with gratifying results in minimizing smoke and in saving of fuel.

The conclusion outlined in the report are, briefly, as follows:

1. Electrification of the St. Louis terminal is very desirable, as it would increase the comfort and convenience of the traveling public and would eliminate the smoke now contributed by the railroads, which amounts to about one-third of the entire amount of the city's smoke. But, as stated above, it does not follow that electrification is the only solution of the smoke problem.
2. Electrification of railroad terminals for passenger and freight traffic is quite practicable from an operating standpoint.
3. The elimination of the principal grade crossings is necessary on grounds of public safety, and should be completed before electrification is begun.
4. The fixed charges on the capital that would be required to pay for local electrification should be absorbed only in part in through passenger or freight rates. Since the probable increase in suburban traffic alone will not justify electrification in St. Louis, the money to pay for it might either be diverted from needed additions to terminal facilities, or might necessitate increased local freight or switching charges; resulting in either case in an added burden upon the manufacturing and commercial industries of the city, which should be taken into consideration.

The estimated cost of electrical installation alone is given as $17,116,000, or about $65,300 per mile.

Winnipeg Wants to Buy Its Street Railway System.

Winnipeg is considering the purchase of the Winnipeg electric street railway on a basis offered by Sir William Mackenzie last winter of $250 per share. The arrangements under consideration will employ a sum of $15,000,000 in cash for the stock and the assuming of $7,000,000 indebtedness of the company. Mayor Evans, who spent two months in London recently, reports that Winnipeg will have no trouble in raising the required amount if the railway company can show that their present earnings will provide for the necessary current maintenance, interest on debentures and installment for sinking fund that would retire the city's obligation in forty years.

Winnipeg is one of the foremost advocates of municipal ownership in North America. Its greatest enterprise at present has been the completion of the municipal power plant that is capable of providing 100,000 electrical horsepower. The city also owns and operates its water works plant, street lighting system, stone quarry, asphalt plant, parks and boulevard system, fire alarm and high pressure water works.

Municipal Ownership in Birmingham.

The report of Albert Halstead, consul at Birmingham, England, contains a brief statement of the finances of the various public utilities which are owned and operated by the city.

The city of Birmingham owns and operates the gas, street railway, electric supply and water services. For the year which ended March 31, 1911, these undertakings were able to contribute $643,225 for the relief of local taxation.

To this total the gas department contributed $368,012, an increase of $15,227 over the previous year, the largest contribution on record. The street railway department contributed $200,030, an increase of $39,852, while the electric supply department contributed $75,183, an increase of $25,275. The amount allotted for the reduction of taxation is what would probably be regarded as the net profit of each undertaking. This net profit is calculated only after suitable provisions has been made for the payment of interest on money borrowed, for sinking fund and for reserve purposes. For instance, the street railway department appropriated out of its gross profits $318,836 for the payment of interest and sinking fund charges, an increase of $44,159 over the previous year. It also placed to the reserve fund $118,806, which will make that fund aggregate $643,111.

The electric supply department appropriated $172,514 for interest and sinking fund purposes and carried $97,330 to the renewals fund account.

The gas department appropriated out of its gross earnings $48,665 for the sinking fund and $58,398 for its new offices. Before calculating its gross earnings, it made provision for the payment of interest on money borrowed. The department's new record is due to favorable buying of coal, an increased market for its coke, and a larger yield of gas per ton (2,240 pounds) of coal carbonized, for which the work of its chemical research laboratory is credited. This department also, before making its contribution for the reduction of taxation, furnished the city with $94,445, of which $14,630 was the interest from its reserve fund, and $79,815 was the value of the gas it contributed for public lighting within the city. In addition thereto, it contributed $22,212 to public lighting outside the city in those adjacent municipalities to which it furnishes gas. Including the $58,398 appropriated toward the construction of its new offices, its total net profit was $567,398, of which $545,187 are earnings which it is considered will meet expenses that, without this contribution would have had to be paid out of taxation.

One of the principles upon which the Birmingham municipal undertakings are managed is to reduce the cost of their products to the consumer when conditions warrant. This not only satisfies public opinion, but increases the demand for these municipal products. Thus this year the gas department has decided to reduce the price of gas. For lighting, heating and domestic purposes in one premises the reductions are to be as follows per 1,000 cubic feet: Under 50,000 cubic feet per quarter, from 57 cents to 53 cents; 50,000 to 250,000 cubic feet per quarter, from 53 cents to 46 cents; 250,000 to 1,000,000 cubic feet per quarter, from 46 cents to 42 cents. For each additional 1,000,000 cubic feet or portion thereof consumed beyond 1,000,000 cubic feet there is to be a reduction of 2 cents per 1,000 cubic feet until the minimum rate of 30 cents per 1,000 cubic feet is reached.

For manufacturing and motive-power purposes the rates per 1,000 cubic feet are to be as follows: Under 1,000,000 cubic feet per quarter, 36 cents; for each additional 1,000,000 cubic feet or portion thereof there is to be a reduction on the total consumed of 2 cents per 1,000 cubic feet until the minimum of 30 cents per 1,000 cubic feet is reached.

The prices for lighting, heating and domestic purposes and for manufacturing and for motive power purposes are subject to a discount of 5 per cent. for prompt payment, which means within thirty days of the rendering of the account. As practically everybody pays promptly, this 5 per cent. is in actual practice a reduction, so that the price for gas which is charged at 53 cents per 1,000 cubic feet is practically 50½ cents, and the minimum price of 30 cents in practical operation becomes about 29 cents. Prepayment gas meters are used in immense quantities in the houses of the poorer people, penny-in-the-slot meters being provided. The prices for this service have been reduced. With gas fittings and cookers free, the number of cubic feet obtainable for 2 cents has been increased from 28 to 31. With cooker only free, the amount of cubic feet purchasable for 2 cents has been increased from 33 to 35. Previously, in a few cases, rents have been charged for meters, but it has been decided that after June, when all the new rates became operative, all meter rents be abolished except in cases where additional meters are required for the consumer's own purposes.

The electrical supply department has decided to reduce its charges for high-tension purposes. Hereafter consumptions are to be calculated on a quarterly basis instead of an annual one. A reduction from $0.02 to $0.019 per unit is made to consumers using $62,500 to 125,000 units per quarter, and a reduction of $0.018 to $0.017 per unit to consumers using 187,500 to 250,000 units per quarter. The existing rates are to be extended so as to provide for a charge of $0.013 per unit to consumers using between 750,000 and 1,000,000

units per quarter, and of $0.0125 per unit to consumers using 1,000,000 and upward per quarter.

The water department of the city, because of the immense cost of bringing the Welsh waters 70 miles, still continues a charge on taxation. However, the returns for the year ended March 31 show a total increase of 2.25 per cent., or $32,790, over the previous year. The revenue account shows a profit of $1,039,830, an increase of $42,095 over the previous year. The charges on account of capital amounted to $1,405,221, including the provision of $108,591 for redemption of debt and extinction of annuities, or $9,490 more than the previous year, because of the growing requirements of the sinking fund. The deficiency for the year was, however, $365,391, a reduction of $29,082 over the previous year. To meet this deficiency $316,323 will be raised by taxation, the balance being otherwise provided for.

In view of this charge of $316,323 on the city revenues on account of the water department, the actual net profits of all the city municipal undertakings are reduced from $643,225 to $326,902, which is in itself a noteworthy contribution to the reduction of taxation, the largest that has been made since the city engaged in business on its own account.

Des Moines Municipal Market.

How to reduce the high cost of living has been solved by consumers who have established a permanent market place in Des Moines, Iowa. The city officials turned the city hall lawn over to the vegetable and farm product venders. On the first day the rush of consumers began at 6 o'clock. Two hours later the hucksters had sold out. New potatoes were bought for forty-five cents a peck, or $1.75 a bushel, where formerly the price had been $3 to $4 per bushel. Apples, which had been selling at twenty-five cents a peck, were sold for ten to twelve cents. Cucumbers found ready buyers at three for ten cents, against the price of ten cents each, which had been prevailing.

Men, women and children jammed the street in front of the city hall in an effort to get to the wagons. The services of a squad of police were necessary to keep the crowds in line.

Municipal Efficiency Bureaus.

A municipal committee in St. Louis has just issued an interesting and important eight-page pamphlet, the aim of which is to exert influence toward establishing in that city and other cities a municipal efficiency bureau, or, as it is more commonly called, a bureau of municipal research. This committee has collected information concerning the workings of such bureaus where actively in operation—in New York, Chicago, Philadelphia, Cincinnati, Milwaukee and Memphis.

It defines them as institutions "designed to introduce into public administration the most economical methods of private business, to prevent waste and to provide an effective agency of citizens' inquiry—to ascertain exactly how the public business in transacted, to bring this information to the people in digestible form and on the basis of exact knowledge to assist city administrations in increasing efficiency."

In New York, where the bureau of municipal research is credited with having saved the city several millions of dollars, the cost of its maintenance last year was $100,000; in Chicago, $55,000; in Philadelphia $30,000; in Cincinnati, $35,000; in Memphis, $12,000, and in Milwaukee, $25,000. In New York the greater part of the expense is contributed by about a dozen citizens, although there are between a hundred and two hundred smaller contributors. In Chicago fourteen men subscribed $114,000, and an additional $3,000 was sent unsolicited. The Philadelphia bureau is supported largely by the contributions of a small number of men, as is also the fact in Cincinnati and Memphis. Milwaukee is apparently the only city which supports such a bureau by public funds, $20,000 being appropriated for this purpose.

In the pamphlet the purposes of the bureaus are well outlined, as follows:

1. To ascertain the powers and limitations of each city official; to eliminate conflicts of power and administrative jurisdiction and to suggest methods of preventing waste and inefficiency.

2. To aid public officials in securing the information necessary to effective administration; to preserve such evidence of transactions as is necessary to locate responsibility, and to inform the public of service performed and the cost thereof.

3. To scrutinize the general system of accounting and make constructive suggestions for improvement.

4. To examine the methods of purchasing materials and supplies and the letting of contracts.

5. To improve budgetary proceedings and assist those who make appropriations in securing that classified and exact knowledge which is necessary to prevent carelessness and waste in appropriating the public funds.

6. To furnish the public with exact knowledge regarding public revenues and expenditures and thereby promote efficiency and economy in public service.

The methods of procedure are, briefly:

1. Confer with public officials and secure their co-operation and that of their subordinates in remedial work.

2. Prepare a digest of the powers and duties of the department or office by an examination of the statutes, ordinances and rules pertaining thereto.

3. Prepare a chart of each department or office showing lines of authority.

4. Examine the public records, analyze

the information contained therein and make collateral inquiry concerning matters in which the records may be defective.

5. Compare functions and expenditures with work accomplished and results obtained.

6. Hold frequent conferences between members of the bureau's staff and also between the latter and public officials on methods used and facts disclosed.

7. Submit formal report to officials on organization, powers, duties and present methods of business procedure.

8. Submit critical report to officials and general public containing constructive suggestions and procedure incident thereto.

9. Continue educational work until something definite is done to remedy unbusinesslike methods disclosed; assist officials in installing new systems recommended by the bureau, or change in former systems.

10. Support publicity by verifiable data, illustrations, budget exhibits, etc.

The Garden City Movement in England.

The "Garden City" was instituted about thirty years ago as a housing adjunct for a great industrial enterprise. In 1887 the firm of Lever Bros., soap manufacturers, bought some land between Birkenhead and Liverpool on which to build homes for their employes. The first houses constructed were too costly to be profitable, and of late years the expense of maintaining roads and parks has risen so that on an investment of $1,500,000 there is no profit after the payment of fixed charges; but Mr. Lever believes in carrying on the enterprise, because employes living in a community which promotes good health are more intelligent and ecient.

In 1902 a tract of 3,800 acres, at $200 per acre, was bought by the First Garden City, limited, 1,200 acres being designed to house a population of about 30,000 people. The remaining 2,600 acres are devoted to an agricultural belt which encircles the town and which shall remain inviolate. A limit of twelve houses to the acre has been established, and a conscious effort has been made to provide housing facilities for all sorts and conditions of men, the rents ranging from $5 to $6 a month up to $40 or $50.

A part of the property, lying close to the railroad but screened by a hill and a belt of trees, has been set aside for factory enterprises. Already more than twenty different enterprises have left London and found it to their financial benefit to operate their works on cheap land, where the homes of the operatives may be within walking distance of their work.

The directors have wisely held the most attractive portion of the land for a future civic center. The population of Letchworth is now 7,000; and the idea is to use small temporary municipal buildings until the city approaches its final population of 30,000.

The most attractive London suburb, Hampstead Garden, which is only twenty minutes from the heart of London, was developed by the Hampstead Garden Suburb Trust, which, for $2,500 per acre, bought from Eton College 240 acres of rolling country bordering Hampstead Health. The building upon the property is upon a preconceived plan, designed by Barry Parker and Raymond Unwin. The land is not sold, but lots are rented for 999 years. Three very successful copartnership societies have built homes, all of which must be approved by the architects so that the harmony of the treatment may not be disturbed. Only eight houses are permitted to the acre, so that there are ample gardens and open spaces. The informal treatment of the streets and the placing of buildings, sometimes in groups of two and three, have produced very charming street pictures.

The houses in Bournville, another of the "garden cities," are attractive brick structures with gardens in front and behind. The "Village Trust" offers prizes for the best-kept garden and for the finest fruit and vegetables. With this incentive the gardens are always neatly cultivated, and it has been estimated that the produce raised reduces the rent of every family in Bournville nearly fifty cents a week. There are tennis and football fields, a swimming pool and a gymnasium. The death rate in Bournville is five per 1,000, while in Birmingham, only four miles away, it is fifteen.

The Bournville boys of twelve are three inches larger around the chest than their city neighbors in Birmingham. The enterprise was made over in 1900 by George Cadbury to a perpetual trust, which will carry out his ideas. The undertaking is on a strictly business basis, the net profits of about 4 per cent. being devoted to the building of more houses.

Freight Transportation Within Cities.

Freight transportation within cities must be furnished by railway companies, according to a decision of the State Railroad Commission of Ohio. This decision reverses the practice of most railways, which have hitherto refused to make reasonable rates for freight service to and from points within a city's limits. Under this decision such service must be rendered by the railways if desired and is subject to rate regulation. The case in which the question was tested was brought by the Akron Gravel & Sand Co. against the Baltimore & Ohio and Erie railways.

A Code of Ethics for Consulting Engineers.

The American Institute of Consulting Engineers of New York has recently completed a code of ethics and schedule of fees for consulting engineers. This code, which was formulated by a committee consisting of John F. Wallace (Ch.), H. W. Hodge, L. B. Stillwell, F. A. Molitor and Prof. George F. Swain, has been adopted by a vote of the

society. A copy of the code is given herewith:

CODE OF PROFESSIONAL ETHICS.

It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of The American Institute of Consulting Engineers:

(1) To act for his clients in professional matters otherwise than in a strictly fiduciary manner or to accept any other remuneration than his direct charges for services rendered his clients, except as provided in Clause 4.

(2) To accept any trade commissions, discounts, allowances, or any indirect profit or consideration in connection with any work which he is engaged to design or to superintend, to in connection with any professional business which may be entrusted to him.

(3) To neglect informing his clients of any business connections, interests or circumstances which may be deemed as influencing his judgment or the quality of his services to his clients.

(4) To receive, directly or indirectly, any royalty, gratuity or commission on any patented or protected article or process used in work upon which he is retained by his clients, unless and until receipt of such royalty, gratuity or commission has been authorized in writing by his clients.

(5) To offer commissions or otherwise improperly solicit professional work either directly or by an agent.

(6) To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of a fellow engineer.

(7) To accept employment by a client while the claim for compensation or damages, or both, of a fellow engineer previously employed by the same client and whose employment has been terminated, remains unsatisfied or until such claim has been referred to arbitration or issue has been joined at law or unless the engineer previously employed has neglected to press his claim legally.

(8) To attempt to supplant a fellow engineer after definite steps have been taken towards his employment.

(9) To compete with a fellow engineer for employment on the basis of professional charges by reducing his usual chargess and attempting to underbid after being informed of the charges named by his competitor.

(10) To accept any engagement to review the work of a fellow engineer for the same client, except with the knowledge or consent of such engineer or unless the connection of such engineer with the work has been terminated.

SCHEDULE OF FEES.

As a general guide in determining fees for professional services, The American Institute of Consulting Engineers recognizes the propriety of charging: A per diem rate; a fixed sum; or a percentage on the cost of work, as follows:

Per Diem Rate.—(1) Charges for consultations, reports and opinions should vary according to the character, magnitude and importance of the work or subject involved and according to the experience and reputation of the individual engineer, from $100 per day to a higher figure, and in addition where expert testimony is required or where otherwise conditions warrant so doing, a retainer varying from $250 to $1,000 and upwards. An additional charge should be made for all actual expenses, such as traveling and general office expenses and field assistants and materials, with a suitable allowance for indeterminate items. In such cases six hours of actual work should be considered one day, except that while absent from the home city each day of 24 hours or part thereof should be considered one day, irrespective of the actual hours of time devoted to the case.

Fixed Sum.—(2) A fixed total sum for above mentioned services may be agreed on in lieu of per diem charges. A fixed sum may also be charged for a portion or all of the items of preliminary surveys, studies, examinations, reports, detail plans, specifications and supervision, including all of the expenses above recited under per diem rate.

Percentages on the Cost of Work.—(3) For preliminary surveys, studies and report on original project, or for examination and report on project prepared by another engineer, including in both cases all expenses of every nature, except those that may be specifically omitted by agreement—from 1½ per cent. to 3 per cent. on the estimated cost of the work.

(4) For the preliminary stage (3) and in addition thereto detail plans and specifications for construction, including all expenses of every nature except those that may be specifically omitted by agreement—from 2½ per cent. to 5 per cent. on the estimated cost of the work.

(5) For the preliminary and middle stages (3) and (4) and in addition thereto general supervision during construction, including all expenses of every nature, except those that may be specifically omitted by agreement—5 per cent., but more for work costing comparatively small amounts, and from 4 per cent. to 5 per cent. where the amount involved is considerable.

(6) For full professional services (3), (4) and (5) and management, including the awarding of contracts, and including all expenses of every nature, except those that may be specifically omitted by agreement, 10 per cent.; but more for work costing comparatively small amounts, and 6 per cent. to 10 per cent. where the amount involved is considerable.

(7) When desired, the percentage basis may be adopted for one or more stages, supplemented by a daily or monthly charge or fixed sum for the remaining stage or stages.

General Provisions.—(8) The period of time should be designated during which the agreed percentages and daily or monthly charges or fixed sum shall apply and beyond which period an additional charge shall be made.

(9) The percentages are to be computed on the entire cost of the completed work or upon the estimated cost, pending execution or completion.

(10) Payments shall be made to the engineer from time to time in proportion to the amount of work done.

(11) When alterations or additions are made to contracts, drawings or specifications, or when services are required in connection with negotiations, legal proceedings, failure of contractors, franchises or right-of-way, a charge, based upon the time and trouble involved, shall be made in addition to the percentage fee agreed upon.

Ligonier Sewerage Plans Approved.

A permit for the use of the present sewers in Ligonier, Pa., until April, 1912, has been received by the Borough Council from the State Health Department, under the condition that the sewage disposal plant be built as proposed and that arrangements be made to temporarily treat chemically the sewage discharging from the present system. Under the permit all persons who are now using the sewer may continue to do so, provided that some arrangement is made to treat it as it empties into the Loyalhanna at the Market street bridge.

Sewer System Constructed at a Saving to Grand Junction.

The city of Grand Junction, Colo., voted $35,000 to build a sewer system. The bonds sold for 98 and it was said by some that a sufficient amount would not be obtained to complete the work. Formerly it was the practice—as is still done by many municipalities—simply to turn the bonds over to a contractor on condition that he make the improvement.

But the new charter provides that all public improvements must be made directly by the city, and all contracts to private parties, which it was charged might become a source of graft, are prohibited. B. W. Vedder, commissioner of water and sewers, personally superintended the construction.

The work has been completed, and the city records show that its cost was but $26,900, so that there will be a tidy sum of nearly $6,000 to turn back into the treasury.

New York's Proposed Fire Department Extensions.

In the budget for 1912 the fire department of the city of New York will break all records for the amount of money that it asks. To extend and improve the department, Fire Commissioner Johnson requests $11,995,542, an increase of $3,808,002 over the money used for the administration of the department this year.

This great sum is made necessary by the delayed extension of the department. Next year work will be begun on thirty-seven new fire houses, five old ones will be reconstructed and three new fire alarm telegraph stations will be established.

The extension of the paid fire department by forty-two new companies and their equipment alone will cost $1,182,500.

The cost of extending the fire department next year will equal the cost of the maintenance of the entire department twenty-five years ago.

To repair and replace apparatus will cost nearly a million dollars. Some of the apparatus in use today is forty-five years old, and of the most primitive type when shown beside the new motor trucks. To repair and replace these will cost $926,000.

About $750,000 will be required to put in operation the provisions of the Hoey fire prevention act, under which a branch of the fire department will be instituted which will be almost as large as the present tenement house department. To prevent fire loss in the future, Fire Commissioner Johnson asks for high pressure through all districts of the greatest hazard, scientific inspection to prevent fires and greater speed and radius of automobile apparatus.

The fire marshal's investigations reveal that the loss in more than thirty per cent. of all fires is less than ten dollars. This indicates a wide field for the Bureau of Fire Prevention. The prevention inspectors should be able greatly to reduce fires arising out of pure carelessness.

New York's Budget Exhibit.

Preparations for the second budget exhibit are well under way. The arrangements are in charge of Robert McIntyre of the Bureau of Investigation and Statistics in the controllers office, chairman of the exhibit committee. Francis J. Oppenheimer will manage the exhibit, which will open October 2.

The success of the exhibition last year has led Chicago to arrange for a similar one this year. New York will send a carload of exhibits to the Chicago exhibition, and in return Chicago will send a selected lot of foreign and American city planning exhibits to the New York exhibit. Visualization of the immensity of the citys expenditures will be shown by each representing $10,000. The cubes will be piled into large, hollow cubes to show the relation of expenditures in each department to the total budget of $174,000,000, the relation of separate items in each department to the total budget. The items in each department will be massed to show what New York pays each year for separate items in all departments, such as horse hire, automobile maintenance, telephone service, salaries, and wages, supplies, and interest on the city debt.

The League of American Municipalities.

The program of the fifteenth annual contion of the League of American Municipalities to be held at Atlanta, Ga., October 4-6, is as follows:

"Long Time Bonds for City Improvements," T. C. Thompson, mayor, Chattanooga, Tenn.; "Law Enforcement," Marcus B. Cullum, mayor, Duluth, Minn., and Thomas Maloney, mayor, Council Bluffs, Ia.; "Municipal Insurance Bonds," Wilson J. Vance, secretary to the mayor, Newark N. J.; "The Future City," Samuel Carlson, mayor, Jamestown, N. Y.; "City Government by Commission," Ford H. McGregor, Municipal Reference Bureau, the University of Wisconsin, Madison, Wis.; "The Board of Public Welfare of Kansas City, Mo.," Jacob Billikopf, member of the board of public works, Kansas City, Mo.; "What a Live City Can Do Under an Antiquated Charter," J. C. Haynes, mayor, Minneapolis; "Municipal Government, Its Needs and Requirements," J. J. Keeley, alderman, Jackson, Mich.; "The Standardization of Municipal Business," Fred H. Cosgrove, comptroller, Omaba, Neb. John MacVivar, Des Moines, Ia., is secretary of the league.

Commission Government in Trenton, N. J.

In an election at which old-time political methods were conspicuously absent, the voters of Trenton chose five commissioners who will exercise complete control over the city government for the next four years. Trenton is the first of the Eastern cities to adopt the commission plan of government.

The men selected are Frederick W. Donnelly, J. Ridgway Fell, William F. Burk, George La Barre and Edward W. Lee. Three of them, Donnelly, Fell and La Barre, are Democrats, and two, Burk and Lee, are Republicans. Similarly, three are officeholders under the present city government and two are not.

The five commissioners were chosen from a field of ten candidates, who had been nominated two months before from among sixty-eight, who entered the primary contest.

The complete vote for the ten candidates stood as follows: Frederick W. Donnelly, Democrat, 8,394; J. Ridgway Fell, Democrat, 7,959; William F. Burk, Republican, 6,820; George B. La Barre, Democrat, 6,253; Edward W. Lee, Republican, 6,160; Frank H. Hutchins, Republican 5,981; William L. Waldron, Democrat, 5,667; Daniel J. Henry, Socialist, 5,024; Harry E. Evans, Republican, 4,114; James H. Mulheron, Republican, 3,264.

Frederick W. Donnelly, the high man of the tne, is a newcomer in politics. He is a son of the late Richard A. Donnelly, for many years the quartermaster-general of New Jersey. Mr. Donnelly had become prominent through his connection with the Inland Waterways Commission, of which movement he was an ardent supporter.

J. Ridgway Fell is a civil engineer by profession. He is a graduate of Rutgers College and a number of years ago served as city engineer.

William F. Burk is street commissioner of Trenton. He began his political career as a member of the Common Council, to which he was elected in 1901. He served as a member of the General Assembly in 1906 and 1907.

George B. La Barre is a member of the local Tax Board. From 1890 to 1893 he was chief clerk in the office of the Secretary of State under Henry C. Kelsey; later he served as secretary of the Board of Works.

Edward W. Lee holds the position of city comptroller.

Dust Laying with Calcium Chloride.

The highways department of the city of Leeds, England, has recently treated portions of a macadam roadway with granular calcium chloride to combat the dust. Solutions of the same had previously been tried at greater cost and without such satisfactory results.

The road is first well swept and two applications of the chloride are made on succeeding evenings, of about one-half pound per yard, at a cost of about $0.008 per square yard. From personal observation Vice Consul Chas. E. Taylor notes the following: July 19, first application; July 20, rain; second application; July 21, dry breezy day, no dust; July 24, no dust; July 25, heavy thundershowers; July 31, no dust, after a few days of very hot weather; August 9, road in good condition, chloride seems to act as binding; August 10, stiff breeze, but no dust; August 14, road still in good order.

The ordinary sweeping of road was carried on.

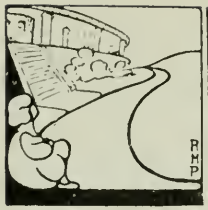
Road Building in Venezuela.

According to the Minister of Public Works, of Venzuela, of the $32,000,000 gold expended in public improvements in Venezuela from 1872 to 1910, only 13 per cent. was dedicated to the construction of roads and highways. The minister adds that "many of our actual roads remain in the same state in which they were in the colonial period." However, a program was outlined by the decree of June 24, 1910, in which a general study of the routes of communication of the country was ordered, and the construction of certain trunk lines which should serve as a base for a general system of cart roads throughout the Republic.

As the minister well says, "The project of a network of communication routes is a complex problem;" but the results of the decree mentioned are apparent in the work already accomplished.

The most important, no doubt, is the Central Tachira road, leading from Uraca, on the Grand Tachira Railway, to San Cristobal, heart of the Maracaibo coffee district, and with branches to the towns of Rubio and Tariba. The length of this road is 108 kilometers (kilometer equals 0.62 mile); width of roadway, 4.50 meters (meter equals 3.28 feet); minimum curve radius, 20 meters, except in difficult places to prevent excessive cost, when it may be reduced to 15 meters; maximum grade, 5 per cent; construction, macadam; bridges, to be of iron, 5 meters wide in the clear, to bear vehicles of 15 tons with axles 3 meters apart; bridge floors, reinforced concrete, covered with macadam. (In ordering iron bridges, parts must be arranged to be adjusted with screws, and not with rivets,) The estimated cost of the entire road is placed at $579,000 gold. Up to February 16, 1911, $87,000 had been expended.

Other important cart roads have been constructed, notably one leading from Caracas to Guatire via Guarenas, about 37 kilometers; from Cumana to Cumanacoa, the latter one of the most important routes of the eastern part of the country. In addition, the repair and maintenance of various important cart roads which were reported almost useless have been brought about; and while the aggregate of cart roads in the country is not yet very great, the new movement looking to the development and extension of the present systems augurs well for the future of the country.



ORGANIZATIONS & INDIVIDUALS

American Association for Highway Improvement—Internation Municipal Congress and Exposition—The Illuminating Engineering Society—The American Road Builders Association — Technical Associations — Calendar of Technical Meetings—Personal Notes.

The American Association for Highway Improvements.

One of the most interesting features of the convention of the American Association for Highway Improvement and congress of its many allied organizations, to be held at Richmond, Va., November 20 to 23, with President Taft as the principal speaker, will be the contest among a number of cities for the next annual convention of the association. Among the cities already entered in the race for the next convention and congress are St. Louis, Mo.; Columbus, Ohio; Colorado Springs, Col.; Nashville, Tenn.; Asheville, N. C.; Washington, D. C.; Chicago, Ill.; San Francisco, Cal., and New York, N. Y.

Trade bodies are aware that after the convention and congress at Richmond, the first of its kind to be held on such an elaborate scale, with all state road officials, manufacturers of road machinery and materials, the farmer, railroad presidents, business men and automobile men participating, there is bound to be a great impetus to the road-building movement, and that it will especially awaken interest in the state in which the convention is held. The year following will undoubtedly be a banner year, with the present record of $1,000,000 a day for road improvement certain to be exceeded. Naturally, the cities where the road movement has had good results want to be honored by and receive the benefits of the next convention and congress.

As the American Association for Highway Improvement has been officially designated by the International Association as the representative of the United States, the American correspondent, Secretary Pennbacker, announces that the American Association will make an effort to bring the next international congress to America. After the convention at London, in 1913, two years will probably elapse before the next congress; and this will give the officials of the American Association plenty of time to agitate the question. They will make their plea for the next congress when they attend the one that is to be held in London.

In connection with the educational work of the association a train is being operated over the Southern railway system. On this train are shown twelve or fifteen models of road construction, the models being miniatures constructed to scale. They are 7 feet long and from 2½ to 5 feet wide, show the different courses as laid in constructing various types of bituminous and other roads; end section of road is shown. Another small model has a small roller operated by batteries which shows the method of rolling a road.

A model of a complete portable stone-crushing plant, with elevators, crushers, screens, etc., is shown. Added to these are small models showing bridge and culvert construction and types of both surface and under drainage. A recent addition is a small model of a brick road showing sand, broken stone and concrete bases and the various types of fillers.

Attached to the good roads train is a lecture car, where meetings are held and enthusiasm is worked up, culminating usually in the organization of local road clubs. The government provides a lecturer and a demonstrator, the association has a representative and the railroad one with this train.

Immediately after the convention in November a similar train will be operated by the Atlantic Coast Line. The N. C. & St. L. and the 'Frisco will have trains in the near future. The M., K. & T. is contemplating something similar, and the Cotton Belt and others have signified their willingness to aid in the work.

When a local organization is formed a definite purpose is insisted upon. It is required that something practical be adopted as the club's aim. A local club is not encouraged in a wild scheme for a coast-to-coast road, etc. The work of the club must not be confined to a number of disconnected meetings, but must be continuous. Committees to investigate problems of coal, materials, transportation, etc., and to make written reports are suggested.

The general purposes of the association are set forth in the following statement:

The membership, beginning with the small

group of distinguished men who were organizers of the association, has grown to between 500 and 600 of the foremost men of the country, who have in consequence turned their attention more than ever to the subject of road improvement.

The following associations have joined the association, recognizing it as the national organization and clearing house: Ohio Good Roads Federation, International League for Highway Improvement, Good Roads Club of Georgia, Arostook County Good Roads Association of Maine, Indiana Good Roads Association, North Dakota Good Roads Association, Montana Society of Engineers, Oregon Association for Highway Improvement, Southern Appalachian Good Roads Association, Southeastern Kentucky Good Roads Association, Knox County Good Roads Association, Memphis-to-Bristol Highway Association, South Carolina Good Roads Association, North Carolina Good Roads Association Gulf Coast Good Roads Association, Arkansas Good Roads and Drainage Association, New Santa Fe Trail Association, Iowa Good Roads Association, Central Highway Association, Capital Highway Association, Inter-Mountain Good Roads Association, Omaha-Denver Good Roads Association.

The aid of the press in promoting the road movement has been enlisted to a remarkable degree through the issuance of a large number of press bulletins and through the personal efforts of officers and members of the association.

The association maintains a small corps of experienced men, who devote their time to lecturing and to the organization of practical working road clubs. This corps consists at present of Mr. J. E. Pennybacker, Jr., formerly chief of road management in the Department of Agrickulture; Mr. Charles P. Light, formerly State Commissioner of Public Roads in West Virginia, and Mr. E. D. Baker, formerly State Engineer of West Virginia.

The association has aided in the preparation of state aid laws and has advised with state officials, legislatures and associations in regard to proposed legislation. Such work has been done in North Carolina, South Carolina, South Dakota and Arkansas, Indiana, Alabama, Tennessee and Maine, but owing to the fact that the association did not establish offices until early last December, there was little opportunity to get in close touch with the legislative situation last winter.

A digest of all state aid and supervision laws has been completed and is now in manuscript form, as well as list of all road officials, organizations, contractors, etc. The decision as to whether this matter shall be published as bulletins of the association or as a year book not yet having been reached.

It has been decided that if the funds of the association permit, the valuable papers and addresses made by engineers and experts at the Annual Road Congress will be published as bulletins of the association, a set of these to go to every member. Whether or not a magazine will be published will depend upon the wishes of delegates and the exhibitors of the Richmond Congress.

Hon. Lee McClung, treasurer of the United States, is custodian of the funds of the association, and all remittances are made to him, and all payments are made on checks signed by him. The salaries of employes of the association are determined by an executive committee consisting of L. W. Page, W. W. Finley, B. F. Yoakum, Alfred Noble and Lafayette Young. No commissions or bonuses are paid to any agents or solicitors, and all expenditures are represented by vouchers filed in the office.

The Municipal Congress and Exposition.

The International Municipal Congress and Exposition opened September 18 in the Coliseum at Chicago, practically ready for business and showed a large number of exhibits of great value.

The most extensive is that of the city of Chicago, which has been arranged with great care and presents an excellent idea of the industries of the municipal family, their methods and results. It includes the records, apparatus and data of every description, from offices of city clerk, oil inspector, railroad track elevation, board of local improvements, smoke inspector, inspector of weights and measures, house of correction, civil service commission, municipal court, department of finance, bureau of statistics, department of public works and health, sanitary district, park commissions, police and fire departments, gas inspector, and a large exhibit of the public schools, which exhibits are supplemented by those from such semi-public institutions as the Historical Society, Woman's Club, School of Civics and Philanthropy, Hull House, Juvenile Protective League, Woman's City Club, Public Library, Chicago University. This series of exhibits is worthy of ten days' study.

The exhibit of New York City is also quite large; and there are very creditable exhibits from some thirty or thirty-five American and foreign cities, including Philadelphia, Pittsburgh, San Francisco, Rochester, Minneapolis, Des Moines, Denver, Cleveland; Antwerp, Belgium; Hamburg, Nuremberg, Germany; Rotterdam, Holland; Port Sunlight, England; Toronto and others.

A number of landscape architects and city planners have also made very creditable exhibits of works done and plans made.

These exhibits are supplemented by those of the manufacturers and dealers in apparatus and materials used in municipal work, which occupy even more space than the exhibits above named and are about eighty in number. Prominent among them are the following: The American Asphaltum and Rubber Company, showing their asphaltic

materials for paving, waterproofing, painting, jointing, roofing and other purposes; the American Association of Creosoted Wood Block Manufacturers; the Acorn Brass Manufacturing Company, with street lamps; the Austin-Western Company, with road rollers; the Baker Manufacturing Company, with grader and snow plow, road drag, dump cart, street cleaning machine, etc.; the Barber Asphalt Paving Company, with materials for asphalt pavements; the Briggs Labor Saving Specialty Company, with street cleaners, dump wagons and carts, concrete spreader, etc.; the Cameron Septic Tank Company, with sewage disposal plants; the Central Westrumite Company, with paving materials; Wm. E. Dee & Co., with sewer pipe and municipal castings; the Eureka Stone and Ore Crusher Company; Robert W. Hunt & Co., with an exhibit of machinery used by them in testing construction materials; the Iroquois Iron Works, with road rollers and asphalt paving plants and tools; the H. W. Johns-Manville Company, with packings, coverings, roofings, etc., of asbestos, sectional conduit, etc.; the Kelly-Springfield Road Roller Company, with road rollers; the Knickerbocker Company, with concrete mixers; the Milwaukee Concrete Mixer and Machinery Company, with concrete mixers; the Nott Fire Engine Company, with fire apparatus; the National Paving Brick Manufacturers' Association; the Standard Oil Company, with road materials, etc.; the Stewart Sewer Cleaner Company; the Sun Vapor Light Company; the Tiffin Wagon Company; Warren Brothers Company, with bitulithic and other bituminous pavements; the Webb Motor Fire Apparatus Company; the Western Gas Construction Company, with ornamental street lighting; the Wisconsin Lime and Cement Company; the Yellow Pine Manufacturers' Association.

Quite an elaborate program was arranged for the International Municipal Congress, accompanying the exhibition, which was well carried out for the two days previous to the date this report was sent to press. On Tuesday, September 19, "City Charter" was the subject for discussion, and was well treated by Professor and Councilman Charles E. Merriam, the chairman; Governor Dix, of New York, in a paper read in his absence; James G. Berryhill, of Des Moines, and Prof. F. H. McGregor, of Wisconsin University. The subject on the second day was "Municipal Accounting and Efficiency," with the principal addresses by Herbert R. Sands, of the Chicago Bureau of Public Efficiency, and Dr. LeGrande Powers, chief statistician of the United States census.

The program for later days included the business end of the city government, municipal history and museums, city planning, woman and the municipality, paving, public utilities, taxation, police and fire service, the city for the people, advertising value of a healthy city, control of a milk supply, public schools, protection of water and disposal of sewage, reduction of fire waste, parks and playgrounds. There is also a full discussion of questions of hygiene and sanitation by a convention of health commissioners.

The only criticism regarding the congress and exhibition is that the advertising campaign was not extended nor attractive enough to bring to them the attendance which their value so fully deserved.

The Illuminating Engineering Society.

Among the papers which were presented at the fifth annual convention of the Illuminating Engineering Society, held in Chicago, on September 25 to 28, inclusive, were the following, of value to those interested in modern street lighting:

"An Analysis of the Requirements of Modern Reflector Design," by F. L. Godinez; "Resume of Legislative Enactments on Illumination," by E. L. Elliott; "The Photometry of Large Light Sources," by George H. Stickney and S. L. E. Rose; "The Manufacture of Glass from the Viewpoint of the Illustrating Engineer," by E. H. Bostock; "Symposium on Illuminating Glassware,' by Bassett Jones, Jr., A. J. Marshall, L. W. Young and G. H. McCormick.

The American Road Builders' Association.

At a meeting of the board of directors of the merican Road Builders' Association, held at the Hotel stor, New York City, on September 2, it was voted to accept the invitation of the city of Rochester, N. Y., to hold the next annual convention of the association in that city, November 14 to 17, inclusive. The program has not yet been made up although at the last meeting of the board of directors it was decided that the papers and discussions should be limited to the subjects of organization, construction and maintenance. According to the present plans, each paper presented will be discussed by two delegates, previously selected, after which the discussion will be open to the convention. At least one session will be given up to contractors.

The Manufacturers' Export Association.

Manufacturers and export managers from various sections of the country will attend the second annual convention of the American Manufacturers' Export Association, to be held at the Hotel Astor, New York City, on September 25th and 26th.

The coming convention will be unique in many ways. It will bring together for the first time in the history of American commerce the leading exporters, manufacturers and export managers in the United States. The sessions will be devoted to practical discussions of the means of systematizing and improving our American efforts for foreign trade. W. B. Campbell, president, Perkins, Campbell Co., Cincinnati, O.; J. H. Cherry, treasurer, Sargent & Co., New York; Henry T. Willis, secretary, New York City.

Technical Associations.

The Wisconsin League of Municipalities elected Mayor Edgerton, Oconomowoc, president; Mayor F. R. Crumpton, Superior, vice-president, and Ford MacGregor, Madison, secretary and treasurer.

In connection with the annual convention of the International Association of Fire Engineers, September 19-22 at Milwaukee, Wis., was held the largest exhibit in the history of the organization. The apparatus shown included 34 motor-driven pieces, including engines, hook-and-ladder trucks, combination wagons, hose wagons and chemical engines.

Among the papers presented at the eightennth annual convention of the American Society of Municipal Improvements, held at Grand, Rapids, Mich., September 26 to 29, were the following: "The Municipal Water-Purification Plant at Grand Rapids," George W. Fuller; "The Sewage Disposal Experiments Conducted by the Sanitary District of Chicago," Langdon Pearse; "Some Examples of Ornamental Street Lighting," Joseph E. Putnam, Assistant City Engineer, Rochester, N. Y.; "Maintenance and Development of Parks," H. S. Richards, Assistant Superintendent, South Park Commission, Chicago; "Bituminous Concrete Pavements," H. G. Lykkens, City Engineer, Grand Forks, N. Dak.; "Notes and Queries on Grouted and Sand-Filled Brick Pavement," Maury Nicholson, City Engineer, Birmingham, Ala.; "Some Observation in Matters of Contraction and Expansion of Vitrified Brick Pavements," Will P. Blair, secretary, National Brick Manufacturers' Association. The last two named papers are printed in this issue of MUNICIPAL ENGINEERING.

The Eight International Congress of Applied Chemistry will meet in Washington, D. C., September 6th to 13th, 1912. An opening meeting will be held on September 4th. Bernhard C. Hess, Ph. D., 25 Broad St., New York City, is secretary. The congress will be attended by officials delegates representing practically every nation.

The thirtieth annual convention of the New England Water Works Association was held at Gloucester, Mass., September 13-15. Among the papers presented were the following: "Hudson River Crossing of the Catskill Aqueduct," by Robert Ridgway, department engineer, board of water supply, New York City; "Coming Efficiency in Water Works Management," by W. H. Richards, engineer and superintendent, water and sewer department, New London, Conn.; "Protection of New York's Water Supply from Pollution During Construction Work," by A. J. Provost, New York City; "The Filtration of Salt Water," by Robert Spurr Weston, sanitary expert, Boston, Mass.; "Organization and Efficiency," by Ermon M. Peck, civil engineer, Hartford, Conn.; "Protection of Steel Pipes in the Catskill Aqueduct," (illustrated), by Alfred D. Finn, department engineer, board of water supply, New York City.

The third annual convention of the Southern Appalachian Good Roads Association will be held at Roanoke, Va., on October 4-5. The list of speakers contains the names of many prominent good roads men, public officials and technical men.

The National Municipal League will hold an annual meeting in Richmond, Va., on November 13-14. Clinton A. Woodruff, 705 North American Bldg., is secretary.

Practically all arrangements have been completed for the allotment of space at the three big cement shows to be held by the Cement Products Exhibition Co., during 1912. The first show will be in Madison Square Garden, New York City January 29 to February 3, 1912; the second at the Coliseum in Chicago, February 21 to 28, 1912, and the third at Convention Hall, Kansas City, March 14 to 21, 1912. This allotment of space by drawing for the three shows will take place at the offices of the Cement Products Co., 72 West Adams St., Chicago, Friday, October 6. All applications should be filed on or before noon, Tuesday, October 3, for the drawing on October 6. Space will be alloted by a similar drawing, immediately after the first drawing, to those exhibitors whose applications are received later than noon, Tuesday, October 3.

Calendar of Technical Meetings.

League of American Municipalities—Annual Convention. Atlanta, Ga., October 4-6. John MacVicar, Secretary, Department of Streets, Des Moines, Ia.

American Electric Railway Association.—Annual convention at Atlantic City, N. J., October 9-12. Secy., H. C. Donnecker, 29 West 39th St., New York City.

Lakes-to-the-Gulf Deep Waterway Association—Annual convention at Chicago, Ill., October 12-14. Secy., Thos. H. Lovegace, Bank of Commerce Bldg., St. Louis, Mo.

American Railway Bridge and Building Association—Annual convention. St. Louis, Mo., October 17-19. C. A. Lichty, secretary, C. & N. W. Ry., Chicago, Ill.

American Gas Institute—Annual convention, St. Louis, Mo., October 18-20. A. C. Beadle, secretary, 29 W. 39th St., N. Y. City.

National Society for the Promotion of Industrial Education—Annual meeting at Cincinnati, Ohio, November 2-4. Secy., Edward H. Reisner, 20 West 44th St., New York City.

National Municipal League—Annual meeting, Richmond, Va., November 13-16. Chilton Rogers Woodruff, secretary, 705 North American Building, Philadelphia, Pa.

American Association for Highway Improvement—First Annual Convention, Richmond, Va., November 20-24. Logan Waller Page, president, United States Office of Public Roads, Washington, D. C.

Technical Schools.

George I. Gay, formerly on the staff of instruction of the University of Illinois, has accepted an oppointment as instructor in civil engineering at the University of California.

Director Albert H. Smith of the College of Mechanical Engineering at Cornell university, known to thousands as "Uncle Pete Smith," is under the care of surgeons as the

result of injuries received in an auto accident.

Ralph D. Brown has been appointed instructor in civil engineering at the Missouri School of Mines. He has been for several years recently engaged as assistant engineer of the O'Gara Coal Company, at Harrisburg, Ill. He is a graduate of Miami University and of the civil engineering department of the University of Ohio.

The board of directors of Wentworth Institute, the new industrial school of Boston, have conducted an investigation for several years to determine the most suitable type of educational scheme to adopt and about two years ago architects were employed to prepare working drawings for the first group of buildings and the general plan for the future growth and development of the institution. This initial group of buildings is now complete. The equipment was rapidly assembled and put in place to be ready for the official opening which took place on September 25th of this year. This new school is of especial interest because its plan is somewhat unique. It is proposed to keep the boy in an ideal modern shop just one-half of his time, while the other half of the day will be spent in drafting, practical mathematics, strength and property of materials, mechanics, elementary e ectricity and similar applied subjects that are directly related to his particular trade. The time will thus be equally divided between actual trade work and the broad general science of the trade. The shops will be equipped with the very best makes of modern tools and apparatus for teaching the essential scientific principles. Arthur L. Williston, a graudate of the Massachusetts Institute of Technology and formerly a member of the faculty of Ohio State University, is principal. He has had experience as an engineer on one of the great western railroads and was a member of the commission which established the Carnegie technical schools in Pittsburgh.

Personal Notes.

Arthur P. Noyes has been appointed City Engineer at Vallejo, Cal.

J. P. Snow, M. Am. Soc. C. E., has opened an office for engineering practice at 18 Tremont St., Boston, Mass., Room 1120.

Messrs. Balcolm & Darrow, engineers, announce the removal of their offices to the Grand Central Terminal Building, New York City.

Walter S. Dickey and Lawrence F. Jones of Kansas City, Mo., have resigned as members of the State Waterways Commission of Missouri.

Austin B. Fletcher, San Diego, Cal., has accepted the appointment of State Highway Engineer of California at a salary of $10,000 per annum.

Frank L. Wilcox of 1227 Chemical Bldg., St. Louis, has been retained by the city of Doniphan, Mo., to prepare plans for a system of sanitary sewers.

The Cement Products Exhibition Co., 72 West Adams St., Chicago, announces the appointment of Mr. F. E. Guy, 528 Frick Bldg., Pittsburg, as traffic manager.

Harry M. Lee, Assistant Engineer of the Water Department of Springfield, Mass., has resigned to accept a position with Hazen & Whipple, Consulting Engineers, of New York City.

Edwin K. Morse, M. Am. Soc. C. E., of Pittsburgh, Pa., has been appointed Consulting Engineer for the city of Pittsburgh in the construction of North Side Reservoir, to be built at a cost of $2,000,000.

Leo Hudson, of Haverstraw, N. Y., has been retained by the boroughs of College Hill and Patterson Heights, Pa., as consulting engineer in connection with the design of sewerage systems and disposal works.

R. D. Culver, president and general manager of the Wabash Clay Co., Veedersburg, Ind., has resigned his position to retire from active work. C. C. Orthwein succeeds Mr. Culver and M. P. Whitney assumes the management.

Geo. R. Stearns, Director of Public Works of Philadelphia, and Wm.R. Knight, Assistant Director of the same department, have also been dismissed by the Mayor. Mr. Stearn's salary was $10,000 per year and Mr. Knight's was $4,000.

Wm. Paul Gerhard, consulting engineer of New York, N. Y., author of works on sanitary engineering, has received from the Technical University of Darmstadt the honorary degree of Doctor of Engineering in recognition of his services in promoting sanitation in the United States.

Trenton, N. J., held an election of officers under the commission form of government. Five commissioners were e ected as follows: F. W. Donnelly, Mayor and President of the Commission; Edward Lee, Commissioner of Revenue and Finance; J. R. Fell, Commissioner of Streets and Public Improvements; George LeBarre, Commissioner of Public Safety, and Wm. F. Burke, Commissioner of Parks.

James B. Morrissey has been appointed division engineer of the New York State Highway Department at Rochester. He was at one time city engineer of Dunkirk, N. Y.

Everett Fowler of Kingston, N. Y., has been appointed deputy state fire marshall, and Peter A. Acritelli, of New York City, second deputy state fire marshall of New York, with salaries of $5,000 and $3,000 per annum respectively.

Thomas H. Johnson, 720 Union Station, Pittsburg, Pa., has retired from active duty as consulting engineer of the Pennsylvania Lines West of Pittsburgh, and is prepared to undertake investigations and reports in connection with reconnaissance for new lines, valuation of railway properties, ventilation of tunnels, investigations of bridges with reference to existing loads, studies for grade reductions, arbitrations, etc.

W. F. Sloan and W. J. Huddle have organized to carry on their advisory and consulting practice under the firm name Sloan, Huddle & Co.. with offices in Carroll Block, Madison, Wis. This firm is equipped for general engineering work and gives especial attention to appraisals, statistical investigations, engineering examinations and reports for rate making, bond issues reorganizations, insurance, industrial purposes.

Harold Parker, M. Am. Soc. C. E., chairman of the Massachusetts state highway commission, has sent his resignation to Governor Foss, to take effect November 1. Mr. Parker is a graduate of Harvard University and was for many years engaged in railway and contracting work. He has been a member of the Massachusetts highway commission since 1900. Mr. Parker, it is reported, has been made a director and vice-president of the Hassam Paving Co., of Worcester, Mass., and will have general charge of that company's contracts in this country and Canada.

MACHINERY AND TRADE

A Power Water Cooler.

The Power Specialty Co., 111 Broadway, New York, are putting on the market a power water cooler which can be used for many purposes from cooling air for residences to refrigeration of air for blast furnaces. It is also used for cooling circulating water for gas engines and for various other purposes.

The machine consists of a horizontal cylindrical chamber or casing, through which air is passed, a rotor within the chamber forming moving cooling surface, a fan for circulating air, and a pump, when needed, for circulating water. The casing is of sheet iron, cast iron, or concrete, according to the size of the machine. The lower part of the casing forms a trough in which water circulates. The rotor, which completely fills the casing, is made up of thin annular plates nested concentrically. The plates are supported from a central shaft which revolves slowly in outside bearings. The fan is mounted on the end of the casing and blows air between the plates.

The air and water are passed through the machine in opposite directions, thus forming counter currents. As the plates slowly revolve they pass through the water in the trough and through the air in the upper portion of the chamber. Thus the freshly wetted surfaces are brought into the most perfect contact with the current of air, at each revolution. The thin film of water on their surfaces is partially evaporated by the air passing over them. This causes the heat given to the plates by the warm water to be rendered latent. Heat is also extracted from the water by conduction. In this manner the cylinders are continually cooling the water. The amount of water evaporated under ordinary atmospheric conditions is from 1½ per cent to 2½ per cent, and is automatically made up by connecting the cooler by means of a ballcock to the ordinary fresh water supply. The power required to operate the cooler, including the fan and circulating pump, is about one-half per cent of the power developed by the engine being cooled.

Sewer Computation Diagrams.

Graphical solution of storm sewer problems, collected and arranged for use in the design of permanent drainage systems by Charles Cottingham, B. C. E., C. E., civil and consulting engineer, Dancille, Ill., is a folio of diagrams comprising:

Rates of maximum rainfall as recorded by self-registering gauge.

Graphical solution of run-off by the formulas of Burkli-Zeigler, McMath, Hering and others, with coefficients used and number of acres drained.

Rainfall curves used in sewer calculations.

Discharge in cubic feet per second for both circular and egg-shaped sewers for different sizes and grades, computed by both Foss' and Kutter's formulas, with mean velocities in feet per second for both brick and pipe sewers. Plotted logarithmically.

Velocities and discharges at different depths of flow.

Short method of recomputing sewer discharges for a changed value of n, in Kutter's formula.

Diagram of run-off based on density of population.

Relation between proportional velocity, proportional dischargo and proportional depth.

Relation between proportional wetted perimeter, area and hydraulic radius and proportional depth.

Gauging stream flow.

Cost of pipe sewers laid at different depths.

Diagrams for earthwork computations.

Diagrams for estimating the yardage of a trench.

Diagram for estimating cost of manholes.

Quantities for brick sewers.

The price on parchment blue-prints in flexible covers is $6.00.

Large Scale and Truck Order.

The Standard Scale and Supply Company, of Pittsburgh, Pa., recently made a shipment of ten carloads of scales and trucks for use at the new plant of Sulzberger & Sons Company, at Oklahoma City, Okla. This order, as well as the one for thirty-five scales (mostly 120-ton railroad truck scales) for the Bureau of Water, Gas and Electricity, of Brooklyn, N. Y., also recently shipped, are the largest orders for this class of goods that have been placed in recent years.

In the equipment for Sulzberger & Sons Company were included a large number of special new pattern portable suspension scales with steel plate platforms, which have recently been put on the market. This scale eliminates the necessity of cutting the floor where the scale is placed, and it is only necessary to use an incline of two inches at

each end to run on the platform. This type of scale is particularly desirable for users where the floors are damp and wet, as there is no opening to allow the water to run through to the floor below. It is particularly adaptable to use in garbage disposal plants for this reason.

Motor Road Rollers.

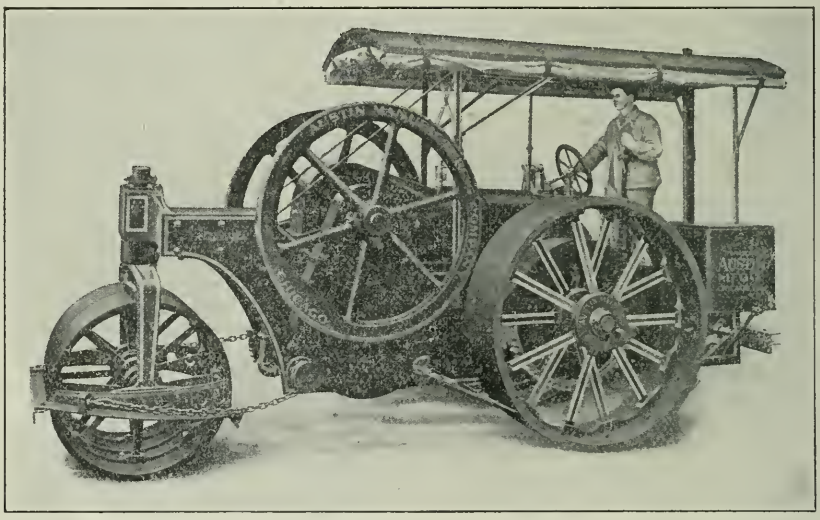
The Austin Manufacturing Company, of Chicago, Ill., announced their first motor roller five years ago and have continued to improve it, with the result shown in the accompanying cut. They show in a handsome catalogue of 88 pages, catalogue D, with full illustrations and descriptions, all the parts of the roller, the factory where they are erected, the details of the engine design and the use to which the machine has been put, both as a roller and a motor for driving stone crusher or other stationary machinery.

The points of advantage over the steam roller which are claimed are also set forth graphically. Thus the fuel and water for a day's run of a steam roller are shown in a full coal cart and a four-wheeled water tank, while those for the motor roller are shown carried by one man with a pail of water in one hand and a can of gasoline in the other. Moreover, the motor roller produces no smoke, sparks, soot or steam. There is no loss of time in making steam, washing or repairing boilers, there is no boiler to explode, and a licensed engineer is not required.

The boiler in a steam roller has a double function to perform, serving also as a foundation and frame for the entire machine. This causes troubles in alignment of bearings and complicates the strains, decreasing the life of the boiler as such and demanding the rebuilding of the machine when the boiler must be renewed. The motor roller, as shown, has a frame to carry the weight to the wheel base, on which is set, independently, the engine.

The manufacturers also claim that the weight is better distributed in the motor roller, and that the distribution remains constant, there being no shifting of water in the boiler when running up or down hill, with consequent change in distribution of weight, and, if the hill is steep or water is low, the danger of burning flues and crown sheet.

The Austin Manufacturing Company makes 7, 8, 10, 12 and 15-ton motor rollers, from which the one best suited to one's needs can be selected.



THE AUSTIN MOTOR ROAD ROLLER.

Comparative Tests of Engine and Turbine-Driven Pumps.

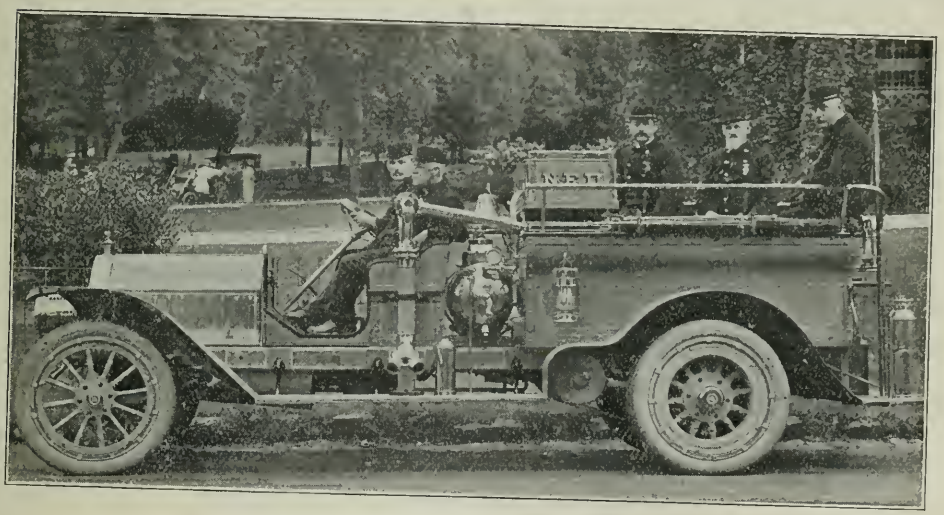
"Comparative Tests for Large Engine and Turbine-Driven Centrifugal Pumps" is the title of an article by Francis Head, Mem. Am. Soc. M. E., which recently appeared in one of the technical journals and has been reprinted by the DeLaval Steam Turbine Company, of Trenton, N. J. The tests were made at the Torresdale Filter Plant, of Philadelphia, where there are installed seven compound-engine-driven centrifugal pumps, each having a capacity of 45,000,000 gallons a day against a head of about forty-five feet; and one steam-turbine-driven centrifugal pump of a capacity of 50,000,000 gallons a day, against the same head. During the past year six of the engine-driven pumps and the turbine-driven pump have been carefully

tested for economy, according to the specifications, by representatives of the contractors and of the city. The pamphlet gives the detailed results of the test, which show that the turbine-driven pump developed a duty over 21 per cent. in excess of the duty shown by the compound-engine-driven pump, and required less attention and seemed to be more easily maintained.

The economy developed by the turbine pump was 104,000,000 foot-pounds of work per thousand pounds of steam, not crediting the pump with the head lost in the condenser and power consumed by condenser. While this may appear low in comparison with the duty shown by vertical triple-expansion crank-and-flywheel pumping engines, it should be borne in mind that the annual charges against turbine-driven pumps are very small alongside of those upon expensive high-duty pumping engines, and that the total cost of pumping per year, with coal at $5 per ton and less, will, in most cases, come out decidedly in favor of the turbine-driven pump. In tenders recently made to one of the large cities in this country, for instance, it was found that the total operating cost, with coal at $3 per ton, would be $43,372 per year for the triple-expansion engine having a duty of 170,000,000, as against only $27,846 for the turbine-driven centrifugal pump having a duty of 120,000,000 foot-pounds per thousand pounds of steam. As a matter of fact, the actual cost of coal was only $1.50 per ton; and further computation shows that, in order to bring the cost of pumping by the turbine-driven centrifugal pumps up to the cost of pumping by the vertical triple-expansion reciprocating pump, the price of coal would have to be in excess of $13 per ton. Copies of the booklet mentioned will be sent to interested persons upon request.

New Automobile Chemical Engine at Norristown, Pa.

The Montgomery Hose Company, Norristown, Pa., is rejoicing in the possession of a handsome automobile chemical engine and hose wagon. The car is shown in the accompanying illustration. The car is designed to carry 1,000 feet of 2½-inch fire department hose, and has a chemical tank with a capacity of 40 gallons, that is placed directly back of the driver's seat. There is seating capacity for ten men and standing room for many more. The equipment comprises a door opener, axe, crowbar, lanterns and two three-gallon Boyd-Plunger fire department extinguishers. On the left-hand side is a large turret nozzle of the invincible type, capable of combining two streams from pumps or hydrants and throwing a single powerful stream which can easily be directed by one man. The hose basket carried over the front end of the body is able to carry 200 feet of chemical hose.



CHEMICAL ENGINE FOR NORRISTOWN, PA.

The car with the regular load can attain a speed of from 40 to 50 miles per hour on level roads. On a recent test, it carried 19 men and full equipment up a 7½ per cent. grade at the rate of 20 miles an hour. The car was designed and built by James Boyd & Brother of Philadelphia and is attracting a great deal of attention and favorable comment in and around Norristown.

The Johnston Oil and Tar Spraying Machine.

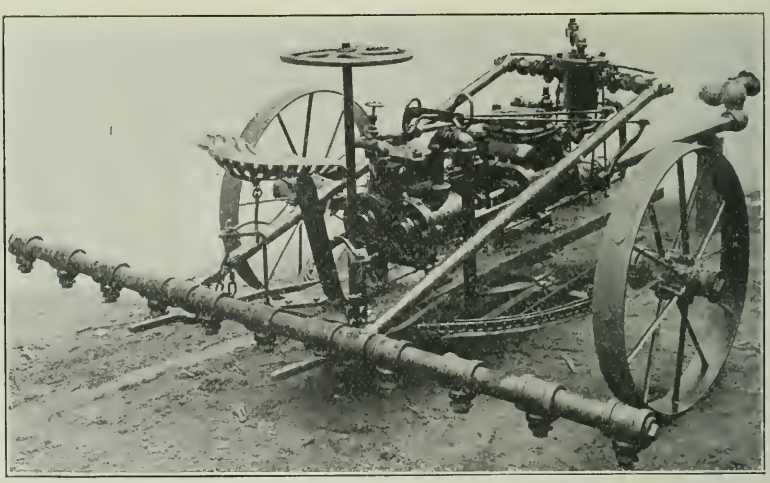
The Massachusetts state highway commission has been one of the foremost advocates of the surface treatment method of road construction and maintenance, and the great number of excellent roads within the state and the prominence given to Massachusetts among the states foremost in the good roads

movement, testifies to the soundness of their judgment in this particular line. J. A. Johnston, one of the division engineers of the Massachusetts highway commission, under whose direction a good deal of the work of saving the famous state roads of that state has been done, has produced a machine which from his experience of the needs, will apply any bituminous material so as to preserve the surface of a macadam road or to build up a gravel one.

The Johnston spraying machine, shown in the accompanying photograph, is constructed as a separate unit, mounted on two wheels, to be attached behind a tank wagon, and the whole to be drawn by a steam roller, or tractor, from which steam is supplied for heating the oil or tar, and operating the sprayer.

The spraying machine consists of a duplex steam pump with fittings so arranged that without this, it is difficult to so guide the tractor that the desired area is properly covered by the distributor. The control of the quantity, and place of application of any material used is at the will of the operator.

The greatest economy is obtained from the machine by using the lightest form of wagon possible. Any grade of oils or tars from the lighter to the very heavy bitumens may be applied with this machine. It is manufactured by the Standard Manufacturing Company, 186 Union St., Worcester, Mass.



THE JOHNSTON OIL AND TAR SPRAYING MACHINE.

as to give the best results with the least trouble. All parts are readily accessible and easily cleaned. The machine is equipped with a regulator valve which can be set to give any desired pressure, up to double the steam pressure used to drive the pump, and as the pump is of the high pressure type, heavier forms of bitumen can be used than is possible in other machines. The suction connections with the tank wagon are all metal, there is no rubber hose or gasket, to rot out, under the action of hot bitumen.

There is a seat for the operator on the rear of the machine, with controlling valves and levers for steam and bitumen within easy reach of his hand, and a steering wheel before him by which he can govern the course of the machine to any desired position within several feet either side of the track taken by the tank wagon.

The importance of this feature has been found to be very great, for experience shows

An Efficient Waterproofing.

The American Asphalt and Rubber Co., 600-614 Harvester B'dg., Chicago, Ill., have a new waterproofing compound which is a result of their former experience in the waterproofing business. The material, known as "Sterling" Waterproofing Paste, may be used in the mass as a plaster coat in the waterproofing of tunnels, subways, reservoirs, bridges, aqueducts, retaining and foundation walls, etc. The material is white and of a thick creamy consistency, and this paste waterproofing is mixed in mortar coating in the proportion of one gallon paste to 15 gallons water, and in concrete of a fair average mix in the proportion of one gallon paste to 18 to 20 gallons water. This cream colored water is used instead of the ordinary clear water in bringing mortar to the proper plasticity and concrete to the proper consistency.

It is permanent in its results, owing to the fact that after a time it becomes not only a barrier but a chemical repellant of water. It does not discolor the concrete in which it is used.

An exhibit at the Municipal Congress and Exposition held in Chicago, September 18-30, showed nine inch concrete cubes water-

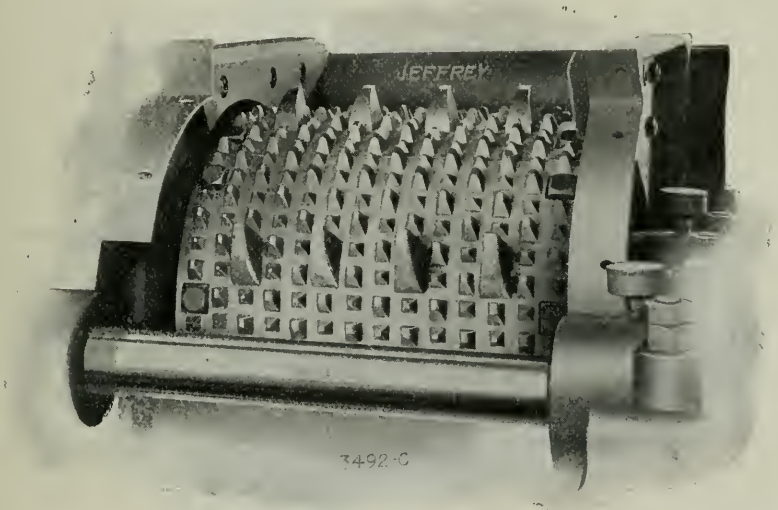
proofed with "Sterling" Waterproofing paste, which, since July 29, 1911, have been under a constant water pressure of 55 lbs., or equal to a head of water of 124 feet, a pressure of 50 lbs., equal to 112 foot head of water was maintained constantly throughout.

The Jeffrey Single Roll Crusher.

The growing demand for chain stokers has created a demand for fine coal in power plant use. The knowledge of the higher efficiency obtained by using stoker only in a finely divided state has led to a demand for as small sizes as may be consistent with practical firing. The two or three-inch lump coal, formerly considered satisfactory, has been reduced to one-inch and smaller, depending upon the type of stoker. The demand for screenings has grown to such an extent that in many sections it is already greater than the output of the mine screens. To meet this demand and to dispose of the surplus lump, many of the coal operators are finding it necessary and highly profitable to install crushers for reducing the lump coal to smaller sizes. The Jeffrey single roll crusher, shown in the accompanying illustration, has only recently been placed on the market. This crusher is built for use either at the tipple or may be mounted on wheels to operate on a trackway over the storage bunkers. The design of this crusher is extremely simple, consisting of a heavy cast-iron plate frame, in which are mounted a crushing roll and a breaker plate. The breaker plate is hinged at its upper edge and held in position by a pair of adjusting rods, enabling the roll to be varied to give any product required.

Toothed segments are bolted to the convex surface of the drum, so as to completely cover it. The frame and hopper are so arranged that by removing the light steel guard plates access may be had to the bolts and the segments removed and replaced by new ones without disturbing either the roll or the hopper. This will be found very convenient when crusher is installed in connection with a large hopper or complicated chute. The long hooked teeth not only act as feeders, but they positively grip the large pieces and break them up to a size to readily enter the maw of the machine.

Narrow gaps in the shoe of the breaker plate enable the long teeth to pass without dragging over-size pieces with them. This arrangement makes it possible to handle large pieces and reduce them to the requisite fineness.



DRUM OF JEFFREY CRUSHER

By making the smaller teeth on the segments of the peculiar shape shown, the proper reduction is made with a minimum amount of slack. The toothed segments are usually made of a very hard iron, each segment being in a single piece. This forms a very durable and satisfactory roll surface. For exceptionally severe work the long teeth are made of cast steel and inserted into the body of the segment.

The coal is received in any volume without a mechanical device for regulating the feed. An efficient safety device protects men against shocks or accidents. By making all reduction simultaneously it accomplishes in a single operation the results which usually require two operations in two separate machines.

The Jeffrey single roll crusher is especially adapted for electric motor drive. A belt from the motor pulley to the band wheel on the crusher being all that is usually required. When space is very limited the pulleys and belt are replaced by a pair of gears, having the same safety device.

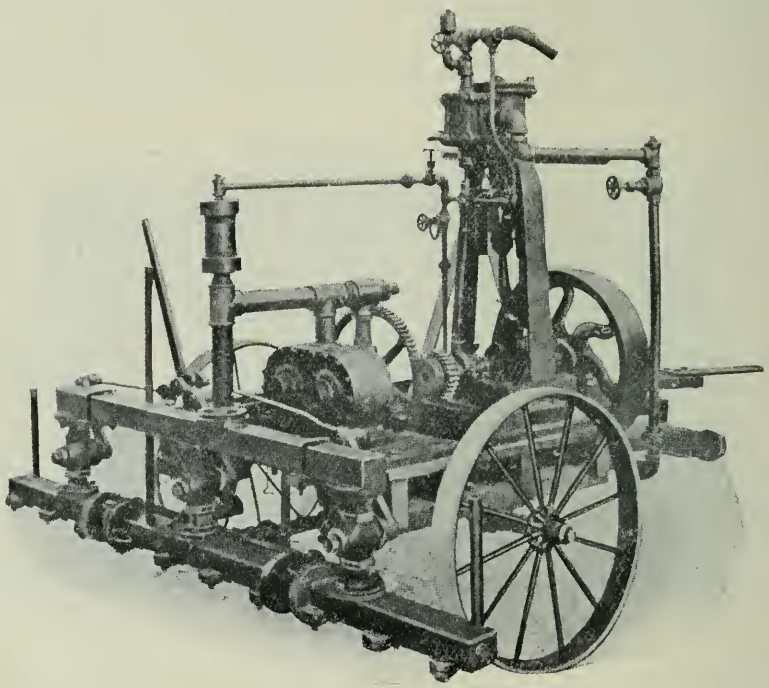
The H. P. Spreader for Bituminous Road Materials.

The accompanying photograph shows a new type of road machine, used for spreading bituminous materials. It handles all material that is fluid at or below the temperature of exhaust steam. It is easily attached to any tank wagon, and the two are drawn at an even pace by a road roller or traction engine, which also supplies steam for the little engine on the spreader. Exhaust steam from this source is utilized to keep the material fluid until it leaves the nozzles. Superior results are obtained through the use of a new type nozzle, ten in number, located on the under side of the distributing duct. Sufficient pressure is supplied from the pump, and the material issues in a series of fan-shaped jets. These jets slightly overlap, forming a sheet; and the result is a marked evenness of distribution.

When long hauls from the supply care are necessary, this machine can be operated with a group of tank wagons, greatly reducing the cost of output. It is built and sold by the A. Burlingame Company, Worcester, Mass.

Pressed Steel Forms for Concrete Sidewalks.

The Pressed steel form for concrete sidewalks manufactured by the Berger Manufacturing Company at Canton, Ohio, are made on a principle which is new and simple in operation. They consist of rigid side rails, which are furnished regularly in length of 4, 6, 8 and 10 feet, but can be furnished up to 14 feet in length; cross plates, which serve the double purpose of holding the side rails in place and also dividing the walk into the required sized blocks; 6-inch radius curves, for connecting intersecting walks and for the inside of curves; and flexible side rails for the outside of curves of any radius.



THE H-P SPREADER.

One end of each rigid side rail has a plain flange which fits into the lapped flange of the receding length, making a concrete-tight joint. The outside edges of these side rails are turned under. The cross plates are made in various lengths, so that the width of the various walks can be varied. The cross plates fit snugly into either the flexible or rigid side rails at the point desired to make a square block, and are held securely in place by means of a spring wedge. The spring wedge makes a convenient, easy means of securing the forms, yet holds them so securely and rigidly that there is no possibility of their coming loose. There are no projecting rivet heads to interfere with the finishing tools.

The Berger Manufacturing Company issue a booklet on concrete sidewalk construction

describing the steel forms, a copy of which may be had by addressing them at Canton, Ohio.

Trade Publications.

The Watson-Stillman Co., 50 Church street, New York City, have issued a new catalog of hydraulic pumps and accessories. A large variety of pumps ranging from light test pumps to heavy duplex steam and motor-driven geared hydraulic pumps are shown. In addition to these, accessory parts such as hydraulic gauges, jacks, force presses and parts are described. The catalog is referred to as Catalog No. 81.

The Clay Products Publicity Bureau, Kansas City, Mo., have three valuable publications for distribution. The first of these, "Sewer Failures," deals with some specific instances of failures of cement pipe. Photographs are shown and data is given to show the effects of acids, alkalies, sewage and sewage gases on Portland cement concrete. The second, "Sewer Facts," gives some valuable data on the estimation of quantities of sewage, the calculation of sizes and a number of other points of value in sewer designs. It is fully illustrated by photographs, and a number of tables of discharge, per capita consumption of water, etc., are given. The third, "Sewer Specifications," gives complete brick and pipe sewer specifications together with data and instructions concerning the handling of all details of the work.

The Henry R. Worthington Co., 115 Broadway, New York, has a catalog of meters which includes the duplex piston pattern, the disc pattern, the turbine pattern, and the straight flow pattern.

"Water Works and General Pumping" is the title of a booklet by the Fred M. Prescott Steam Pump Co. of Milwaukee, Wis. It deals with heavy water works pumping engines.

The Jeanesville Iron Works Company, Hazleton, Pa., has a catalog of centrifugal pumps which shows pumping machinery for water works or mine service, power pumps for water works or mine serice (horizontal or vertical), centrifugal pumps for the same service.

The Medusa Portland Cement Co., Sandusky, Ohio, have a booklet on waterproofing, which describes the Medusa Waterproofed Portland Cement and gives a number of tests to which it has been subjected.

Byerlyte oil for waterproofing concrete, "Byerlite" waterproofing, and "Byerlyte" for paving are the subjects of three pamphlets issued by Byerley & Sons, Cleveland, Ohio.

The Robinson Fire Apparatus Manufacturing Co., St. Louis, Mo., have recently issued a complete catalog of their apparatus and a set of specifications of their triple automobile combination chemical engine, hose wagon and fire engine.

Trade Notes.

ASPHALT.

New York, N. Y.—The Standard Asphalt Company has been incorporated with a capital stock of $1,600,000.

LIGHT, HEAT AND POWER.

Corydon, Ia.—Special.—The city is planning the reconstruction of the electric light system, including new engines, generators, boiler, etc. J. J. E. Fowler, town clerk; Iowa Engineering Co., Clinton, Ia., engineers.

Cincinnati, Ohio.—The Westinghouse Electric & Manufacturing Co. has received an order from the Cincinnati Traction Co. for equipment for a generating station and three substations, comprising a 6000-kva, 25-cycle, 13,200-6000-volt, three-phase, turbo-generator, with direct connected exciter, five 1500-kw. rotary converters, 16 500-kva transformers and four switchboards.

MACHINERY AND SUPPLIES.

Indianapolis, Ind.—Special.—The Carson-Payson Co., 316 Pythian Bldg., desires catalogs and prices on a concrete mixer, wheelbarrows, concrete spades and other contractors equipment. They also desire quotations on sand, stone, cement and lumber for forms.

Indianapolis, Ind.—The Troy Wagon Works Co., Troy, Ohio, has engaged F. L. Holloran, of Indianapolis, Ind., as a dump wagon traveler. He has been engaged for the last ten years in superintending steam shovel work.

Holyoke, Mass.—The Dean Steam Pump Company, of Holyoke, Mass., has been given a contract by the Plainfield (Conn.) Water Company for a pump and a 50-hp. De La Vergne oil engine. The pump has a rating of 500 gallons per minute.

St. Paul, Minn.—City Engineer Clausen has recommended the purchase of six new street flushing machines.

Cincinnati, Ohio.—Supt. Laidlaw has requested $1,225,443 for the maintenance of the water works department during 1912.

Cleveland, Ohio.—The Municipal Sanitantio Company has been incorporated by Henry A. Beckerman, S. J. Deutsch, W. P. Deutsch, E. L. Fischer and F. V. Bernstein.

Marshall, Ill.—The city is contemplating the purchase of a new boiler for the electric light plant.

New York, N. Y.—Bids will be received October 2, at 10:30 a. m. for furnishing two 3-ton motor trucks and two 1½ ton motor trucks by Joseph Johnson, fire commissioner.

New York, N. Y.—The Uvalde Asphalt Paving Co., 1 Broadway, desire to purchase one or more second-hand 5-ton asphalt rollers.

Windsor, Ont., Can.—Bids will be received October 12 at 12 m. for furnishing 500 ft. of 60-inch steel pipe and constructing concrete screen well 18 ft. by 30 ft. W. A. Hanrahan, secretary.

MISCELLANEOUS.

New York N. Y.—Special.—The Destructor Company, Power Specialty Company, manager, 111 Broadway, New York City, have received the contract for furnishing Heenan refuse destructors to Calgary and Moosejaw, Canada. The Calgary plant will have a capacity of 75 tons per 24 hours, while that furnished Moosejaw must consume 55 tons per 24 hours.

Winnipeg, Can.—Another big firm will probably locate in Winnipeg. The Industrial Bureau reports that negotiations are practically completed for the establishment of a Winnipeg plant by the H. Mueller Company, Decatur, Ill. The Mueller Company makes brass goods and plumbers' supplies, and the west is a particularly rich field for operating such an enterprise. At the main plant the Mueller employ nine hundred hands.

IMPROVEMENT AND CONTRACTING NEWS

PMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Palatka, Fla.—Oct. 3. Approximately 15,000 sq. yds. brick paving and 18,000 lin. ft. curbing. Cy. coun.

Bedford, Ind.—Oct. 3, 1 p. m. Constructing macadamized roads as follows: Pleasant Run township, 6,814 ft.; Shawswick township, 5,500 ft.; Guthrie township, 9,570 ft., and 10,095 ft.; Marion township, 5,652 ft., 13,600 ft., 2,175 ft., 1,840 ft., and 2,612 ft.; Spice Valley township, 5,310 ft., and 5,570 ft. Bond for twice the amount of each bid. Ezra W. Edwards, co. audt.

Bloomington, Ind.—Oct. 4, 10 a. m. Constructing 2 stone roads. Horace Blakely, audt.

Bluffton, Ind.—Oct. 10. Constructing gravel road on line between Allen and Wells county. O. C. Garrett, audt. Wells county.

Danville, Ind.—Oct. 2, 10 a. m. Constructing cement arch in Plainfield township. W. H. Nichols, audt.

Hartford City, Ind.—Oct. 2. Constructing concrete culvert. James Cronin, Jr., audt.

Indianapolis, Ind.—Oct. 4, 10 a. m. Paving Washington boulevard, and Fifteenth street. C. A. Schrader, pres. bd. of pub. wks

Lawrenceburg, Ind.—Oct. 3, 12 m. Constructing two gravel roads. William S. Fagaly, audt.

Logansport, Ind.—Oct. 3, 10 a. m. Constructing gravel roads in Jefferson township. J. E. Wallace, audt.

Renssalaer, Ind.—Oct. 3, 12 m. Constructing one gravel road. James N. Leatherman, audt.

Rushville, Ind.—Oct. 4, 2 p. m. Constructing 11,334 ft. of macadam road in Noble township. Jesse M. Stone, audt.

Rushville, Ind.—Oct. 4, 2 p. m. Constructing 10,317 ft. of road in Richland township. Jesse M. Stone, audt.

Washington, Ind.—Oct. 7, 10 a. m. Constructing gravel road in Elmore and Washington townships. Thomas Nugent, audt.

Williamsport, Ind.—Oct. 9, 1 p. m. Constructing one gravel road. David H. Moffett, audt.

Williamsport, Ind.—Oct. 21, 1 p. m. Constructing gravel road. David H. Moffett, audt.

Winamac, Ind.—Oct. 3. Constructing three gravel roads. W. E. Munchenburg, audt.

Winchester, Ind.—Oct. 13, 10 a. m. Constructing two gravel and four macadam roads. Henry F. Wood, audt.

Bryan, O.—Oct. 3, 10 a. m. Constructing 1.52 miles of macadamied road. Estimated cost of bituminous macadam, $14.078; estimated cost of water-bound macadam, $12,585. Co. comrs.; James R. Marker, Columbus, O., com.

Caldwell, O.—Oct. 10, 12 m. Improving Caldwell and Belle Valley road. Certified check, $50. Hugh F. Neuhart, clk.

Caldwell, O.—Oct. 12, 12 m. Paving Miller street. Certified check, $150. Hugh F. Neuhart, clk.

Cincinnati, O.—Oct. 6, 12 m. Improving Burnt School House road. Fred Dreihs, clk.

Cincinnati, O.—Oct. 6, 12 m. Improving Tanner avenue. Bond, $1,000. Fred Dreihs, clerk for the co. comrs.

Cleveland, O.—Oct. 7, 11 a. m. Improving Fenkell and Solon road. Certified check, $500. John F. Goldenbogen, clk.

Littleton, O.—Oct. 2, 12 m. Paving Tytus avenue, with vitrified brick. Certified check, $1,000. John Koonz, clk.

Marietta, O.—Oct. 4, 10 a. m. Constructing stone road near Fearing township line. Hammond Burton, co. audt.

Ravenna, O.—Oct. 6, 9 a. m. Constructing 7.84 miles of road in Ravenna, Rootstown and Randolph township. Estimated cost, section No. 1, $61,354; estimated cost, section No. 2, $40,938. Certified check, $200 on each bid. James R. Marker, state hghwy. comr.

Warren, O.—Oct. 2, 1 p. m. Improving the Van Neff road. Certified check, $200. W. R. Harrington, clk. co. comrs.

Wyoming, O.—Oct. 6, 12 m. Constructing concrete sidewalks on Crescent avenue. Certified check, $200. W. A. Clark, clk.

Chester, Pa.—Oct. 7. Grading and macadamizing ½ mile of road. M. R. Rambo, engr.

Pittsburg, Pa.—Oct. 3, 10 a. m. Paving construction as follows: Wabash street, including 8,710 sq. yds. asphalt block pavement and 8,200 lin. ft. concrete curb and 80,000 sq. ft. concrete sidewalk; paving Crosby avenue, Griffin street and Wharton street with block stone; paving Brooch alley with brick. Certified check, $15,000 on first item. Bond, 50 per cent. on other items. Joseph G. Armstrong, dir. of pub. wks.

Pittsburg, Pa.—Oct. 4, 10 a. m. Road construction as follows: Homeville road, 2.4 miles; Squaw Run road, .6 miles. Certified check, $1,000 on Homeville road and $500 on Squaw Run road. R. J. Cunningham, co. audt.

Sharon, Pa.—Oct 3, 5 p. m. Paving Boyde street, 1,300 sq. yds. Oscar J. Denny, sec.

Pomeroy, Wash.—Oct. 2, 2 p. m. Constructing permanent road No. 1 in Garfield county. Certified check, 10 per cent. Harry St. George, co. audt.

Huntington, W. Va.—Oct. 5, 1 p. m. Paving the following streets with vitrified brick: Bluffington, Thirty-first, Second, alley between Fifth and Sixth avenues, alley between Third and Fourth avenues. Certified check, $500. John Coon, comr. of sts.; A. B. Maupin, cy. engr.

CONTRACTS AWARDED.

Alhambra, Cal.—Constructing macadam roadway, to Montgomery & Marsh, Los Angeles, $20,000.

Escondido, Cal.—Constructing macadam road, to H. G. Fenton, San Deigo, Cal, $40,000.

Huntington Park, Cal.—Constructing oil macadam pavement and concrete curbs on

Pacific boulevard, to R. H. McCray, Los Angeles, $42,499.

Lodi, Cal.—Paving the principal business streets, to the Ransome-Crummey Co., $35,-672.

Marysville, Cal.—Constructing pavements on Second, Fourth and C streets, to the Clark & Henry Co., Sacramento.

Oroville, Cal.—Constructing bridge, to the Ross Construction Co., $47,500.

Reedley, Cal.—Constructing 680-ft. reinforced concrete bridge, to the Sharp-Fellows Co., of Los Angeles, $160,000.

San Bernardino, Cal.—Paving Eighth street, to Ernest Freuzel, $9,930.

Stamford, Conn.—Paving Elm street, to William H. Arthur.

Wilmington, Del.—Constructing Kennett Square road, to Cornelius Mundy, $24,433; Clayton road, to Juniata Paving Co., $12,-141; Philadelphia and Baltimore turnpike, to Thomas J. Allen, $18,921; Newark and Elkton road, to Stewart & Donohue, $7,972; Pencader hundred section, to Stewart & Donohue, $11,241.

Washington, D. C.—Improving the grounds of the Pan-American building, to Norcross Bros. & Co., Worcester, Mass., $100,000.

Rockford, Ill.—Paving W. State street, 17,785 sq. yds. brick, to A. E. Rutledge, $38,125.

Columbus, Ind.—Constructing Perry road, to Joseph T. Meredith, $20,500.

Indianapolis, Ind.—Constructing Pleasant Run boulevard, to Marion Construction Co., $9,104.

Newport, Ind.—The following road contracts have been awarded: The A. B. Dicken road, to Henry and Rag G. Jester, $3,098; the Hillsdale and Montezuma road, to Ingram Co., $9,946; Range line and Fontannon road, to George W. Sykes, $7,845.

South Bend, Ind.—Paving Third and N. Second streets, to C. H. Defrees, South Bend.

Wabash, Ind.—Constructing the Kosciusko road and the Rittenhouse road, to Geo. N. Sewell, of Lakton, Ind., at $2,480 and $2,375.

Washington, Ind.—Constructing the Hannah road, $2,690, to Ira Cox; constructing the Taylor road, to the same, $3,700.

Burlington, Ia.—Constructing mineral rubber pavement in Court and Fifth streets, to the Springfield Construction Co., Springfield, Ill.

Clarinda, Ia.—Paving construction, to the Piattsmouth Construction Co., of Plattsmouth, Neb., $22,000.

Des Moines, Ia.—Paving several blocks of streets with asphalt, to the Bryan-McLaughlin Co., Des Moines.

Marshalltown, Ia.—Constructing about one mile of concrete pavement, to J. F. McLaughlin & Son, of Red Oak, Ia.

Lawrence, Kan.—Paving contracts have awarded to the following contractors: J. R. Ramsey and W. W. Gilmore.

Wichita, Kan.—Paving the right-of-way of the Wichita R. R. & Light Co., on Franklin avenue, to the Cleveland Trinidad Paving Co., at $2.35 per sq. yd. for paving and 45 cents per cu. yd. for excavation; paving the right-of-way of the W. R. R. & L Co., on Douglas avenue, to John Ritchie & Son, at $2.35 per sq. yd. for brick paving and 45 cents per cu. yd. for excavation.

Franklin, La.—Constructing 98,000 sq. ft. of pavement, to Bowman & Landreth, of Ruston, La.

New Orleans, La.—Constructing state road, to M. Garsaud, New Orleans, $119,680.

Rockland, Me.—Widening and paving Sea street, to D. F. Griffin & Bro., Portland, $19,024.

Greensboro, Md.—Constructing Greensboro-Frederick road, to the Holt Construction Co., of Federalsburg, Md.

Boston, Mass.—Constructing tar macadam roadway in Bay street, Dorchester, to F. S. & A. D. Gore, $7,355.

Boston, Mass.—Constructing artificial stone sidewalks in Thetford avenue, Dorchester, to Adams & Pond Co., $5,058.

Worcester, Mass.—Paving Pleasant street, from Newton Square to Lenox street, to Hassam Paving Co., $26,140.

Grand Rapids, Mich.—Paving Court street, to Hilding & Whiting, $14,000.

Kansas City, Mo.—Constructing the James street bridge, to the Mt. Vernon Bridge Co., of Ohio, $143,871.

St. Joseph, Mo.—Paving Messanie street, with sandstone blocks, to Metropolitan Paving Co., at $2.88 per sq. yd. for Kettle river sandstone blocks.

St. Louis, Mo.—The following paving contracts have been awarded: Grading Kings highway, to William R. Bush Construction Co., $3,208; paving De Balviere avenue, with wood block, to John D. Turner, $44,-323; paving Herbert street, with asphalt, to the Trinidad Asphalt Manufacturing Co., $21,394; paving Benton street, with wood blocks, to the Skrainka Construction Co., $29,293.

Springfield, Mo.—The following paving contracts have been awarded: Paving Batell street, to the Will F. Plummer Paving Co., $2,112; constructing sidewalks, to the Jarrett-Richardson Construction Co., and to W. W. Whittaker.

Kalispell, Mont.—Constructing bitulithic pavement, to the Two Miracle Concrete Corporation, Kalispell, $20,000.

Roundup, Mont.—Constructing cement sidewalks, to the Two Miracle Concrete Corporation, Kalispell, $20,000.

Berlin, N. J.—Constructing gravel road between Berlin and Gibbsboro, to McCullough & Connors, Philadelphia, Pa., $9,309.

Newark, N. J.—Repaving Market street, to the Standard Bitulithic Co., $65,150; improving Fourth and Devine streets, to Wm. Ballard.

Larchmont, N. Y.—Constructing five miles of concrete sidewalk, to Daily & Merritt, Port Chester, N. Y., 18 cents per sq. ft.

Mt. Vernon, N. Y.—Constructing East Lincoln pavement, to the Eastern Asphalt Paving Co., $9,450.

New York, N. Y.—Improving highway Flushing and Astoria road from Old Bowery Bay road to Jackson avenue, Newtown, to Thomas M. Hart, $26,540; Hempstead and Jamaica turnpike, three miles, to Uvalde Construction Co., $46,087; Central avenue, Jamaica, two miles, to Continental Public Works Co., $28,749.

North Tonawanda, N. Y.—Constructing tarvia pavement, to Warner & Downs, of Toledo, O., $8,061.

West New York, N. J.—Constructing 5,-000 sq. yds. asphalt block pavement on Twenty-second street, to Hastings Pavement Co., New York City.

Canton, O.—Paving N. Cherry and Hiram streets, to Logan D. Burd, Canton, $11,-460.50; Arlington avenue, to P. Dieffenbacher & Son, Massillon.

Crooksville O.—Paving constructions, to Bock & Henderson, of Coshocton, $4,260.

Dayton, O.—Macadamizing Covington pike for 1½ miles, to Baker & York, Greenville, $18,824.

Elyria, O.—Constructing two miles macadam road, to the Buckeye Engineering Co., of Norwalk, O., $6,290.

Marietta, O.—Paving Pike street, east of Duck creek, to Cisler & Morse, $13,825.

Newark, O.—The following paving contracts have been awarded: Wilkins Run road, 2½ miles, to Willson & Yardly, $20,-000; Newark-Jacksontown road, 7 miles, to Vogelmeier Bros., $75,000; Granville road 13 miles, to Perdum & Swartz, of Columbus, O., $100,000.

Norwalk, O.—Constructing two miles of

stone road in Wakeman township, to Thomas Burton & Son, Wellington, O., $8,200.

Sandusky, O.—Paving Huron avenue and Taylor street, to Andrews Asphalt Paving Co., Hamilton, O., $16,846 and $14,641, respectively; paving Jackson street, to M. J. Callin, Sandusky, $4,578.

Toledo, O.—The following paving contracts have been awarded: Erie street, to Carpenter & Anderson, $30,255; Buffalo street, to the Central Westrumite Co., $44,562; Mulberry street, to A. A. Reilly, $4,919; Harriett street, to Thomas J. Kelly, $4,386; Belmont street, to Roscoe French, $8,911; Frank street, to D. J. Raymer, $2,499; W. Grove place, to A. A. Reilly, $5,106; Woodland avenue, to Roscoe French, $7,099; Viking street, to M. F. O'Sullivan, $3,898; Detroit avenue, to the Asphalt Block Pavement Co., $29,573; Heston street, to the Central Westrumite Co., $7,411.

Woodsfield, O.—Constructing the Eastern road, to Lewis H. Nixon, Nelsonville, O., $18,499.

Wooster, O.—Paving Apple creek road, to D. R. Houser, Wooster, O., $16,300.

Butler, Pa.—Paving contracts aggregating $20,000 have been awarded to H. A. McManne and to M. J. Boger.

Erie, Pa.—Paving contracts have been awarded to J. & M. Doyle and to John McCormick & Son.

Harrisburg, Pa.—Contracts for road construction have been awarded as follows: Lewistown road, to J. E. Francis, of Punxsutawney, $120,957; the Juniata road, to the United Ice & Coal Co., of Harrisburg, $99,048; two sections of National pike, to Reed & Patton, of Curwensville; constructing one section of National pike, to Charles E. Eastburn, of Yardley, Pa.

Mars, Pa.—Paving Grand avenue, to the Pitts Construction Co., Pittsburg, Pa.

Mercer, Pa.—Constructing the Grove City-Mercer road under the state highway law, to the South Shore Construction Co., Erie, Pa., 3,800 ft.

Pittsburg, Pa.—Grading, paving and curbing Benton avenue, North Side, to Booth & Flynn, $22,000.

Riegelsville, Pa.—Constructing concrete bridge near Springtown, Pa., to the Riegelsville Construction Co.

Warren, Pa.—Constructing 5,800 rods of the Grove City road, to the South Shore Construction Co., of Erie, Pa.

Waynesboro, Pa.—Constructing various street improvements for property holders in Fairview avenue, to Chas. D. Snider.

Wilkes Barre, Pa.—Resurfacing the river road, to the Luzerne Construction Co., Wilkes Barre, $4,400.

Johnson City, Tenn.—Asphalt paving, to the Trinidad Paving Co., of Cleveland, O., $47,000; constructing curbs and gutter, to Geo. R. Brown Concrete Paving Co., $6,500.

Abilene, Tex.—Paving Texas and Pacific streets, to Womack & Barnett, of Abilene.

Dayton, Wash.—Paving Main street, etc., to the Pacific Paving Co., Seattle, $74,15.

Seattle, Wash.—Street paving and sidewalks Sixteenth and Eighteenth avenues, to the Smith Contracting Co., $20,000; Twenty-third avenue, to Allain & Hull, $58,000; Beacon avenue, to P. J. McHugh, $95,000.

Spokane, Wash.—Constructing road, to the J. F. Hill Paving Co., $18,430.

Fulton, W. Va.—Paving Fulton street, to Louis Fax & Co., of Fulton.

Morgantown, W. Va.—Paving Bridge and Kingwood streets, to Arthur M. Lucas & Co.

Wheeling, W. Va.—Paving Forty-first street, to Pickett and Shannafelt.

Milwaukee, Wis.—Ten paving contracts, 194,228 sq. yds., to the R. F. Conway Co., Chicago, $254,703.

Oshkosh, Wis.—A number of contracts for street work have lately been awarded. Dan Witzel, cy. clk.

Vancouver, B. C.—Paving in Broadway, to A. L. Otis & Co., $45,400.

St. Vital, Manitoba.—Paving 4½ miles of highway with bitulithic, to the Bitulithic & Contracting Co., Winnipeg.

CONTEMPLATED WORK.

Fullerton, Cal.—The city has voted to spend $160,000 for street paving.

San Francisco, Cal.—The board of supervisors has set aside $240,000 for street work, including sewers, during the period from September 1 to December 31.

Santa Barbara, Cal.—The board of supervisors of Santa Barbara county have rejected all zids received for the construction of 5½ miles of macadam road construction in the Montecito road district, and will construct the roads by day work. Estimated cost, $45,000.

South Bend, Ind.—The Ideal Concrete Machinery Co. has increased its capital stock to $500,000 in order to enlarge its plant.

Burlington, Ia.—City Engineer Vollmer has prepared plans and estimates for paving Arch street. Estimated cost, $7,171.

have ordered the pavement of all the principal alleys in the business section. J. A. Graves, cy. clk.

Duluth, Minn.—Cook county has voted

Abilene, Kan.—The city commissioners $60,000 for construction of 83 miles of road.

Carthage, Mo.—A committee of the council is inspecting asphaltic concrete and asphalt macadam pavement. The committee is composed of Mayor J. T. Leggett, City Engineer Frank Newcom, G. W. Miller, J. H. Wilbur, Charles Tobin and J. C. Hildreth.

Manchester, N. H.—The common council is considering street and highway improvements to cost $30,000.

Elizabeth, N. J.—Tentative plans have been prepared for paving Elizabeth avenue and Broad, East Jersey and First streets, at an approximate cost of $884,875.

Buffalo, N. Y.—The city council has ordered the paving of the following: Weyand street, 22 ft. wide, brick to Frank avenue; Monroe street, 26 ft. wide, asphalt, between Brown and Genesee streets; Warren avenue, 28 ft. wide, asphalt, between Broadway and Kent street; Krupp street, 28 ft. wide, asphalt, from Ashley street to end of street; Austin street, 28 ft. wide, asphalt, from Military road to New York Central R. R. viaduct.

Rochester, N. Y.—The common council has authorized paving in Jay street, $25,000. Wm. Ward, cy. clk.

Barberton, O.—The city council has authorized the construction of the brick paving and curbs in Cornell street. Jay W. Tracy, clk.

East Liverpool, O.—The city council has authorized the improvement, grading and paving of East Eighth street. C. V. Beattie, dir. of pub. ser.

Hamilton, O.—The city council has ordered paving, etc., in E street. H. B. Grevey, clk.

Niles, O.—The city council has authorized the construction of sidewalks, sewers, etc.

Orrville, O.—The village council has authorized the grading and paving of Elm street. F. E. Wolfe, vil. clk.

Portsmouth, O.—The city council has authorized the paving of Ninth street. William N. Galbeman, clk.

Steubenville, O.—The city council has authorized the paving of N. Sixth street and grading in McKinley avenue and a certain alley. Hugh W. Patterson, clk.

Uhrichsville, O.—The village council has ordered paving in Eastport avenue, $3,600.

Springfield, O.—The city has voted $100,000 bonds for constructing sewers, macadamizing streets, etc.

Brownsville, Pa.—The borough has voted bonds for street paving.

Butler, Pa.—The town council has ordered grading and paving in Shore, E. Cunningham, Spring, Cleveland and Etna streets.

Kearney, Pa.—The town council has authorized the improvement of Hoyt street, etc. Boro clk.

Lewiston, Pa.—The borough council has ordered the grading and macadamizing of S. Main street, 3,852 ft., under the direction of the street commissioner, A. A. Aurand.

McDonald, Pa.—The county is contemplating the construction of four brick highways including the following: Bellevue, Venice-Cecil, Beallsville-Zollarsville, a division of the Washington-Bethany road. The Cecil-Venice road estimated at $53.00.

Monessen, Pa.—The city is contemplating the paving of Twelfth street.

Scranton, Pa.—The city council has ordered the grading and paving of Lafayette street; also paving in Cedar avenue. Evan R. Morris, cy. clk.

Sharon, Pa.—The city is contemplating the paving of Sharpsville street.

Uniontown, Pa.—The council has authorized the city clerk to advertise for bids on paving N. Beeson avenue, Lennox street, Stewart avenue and Union street.

Washington, Pa.—The county commissioners have authorized the construction of four brick roads.

Columbus, O.—The paving of Sumper street with bitulithic is contemplated. R. C. Keenan, supt. of sts.

Marion, S. C.—About 100 miles of sand-clay road will be contracted for in the near future. Will be let in amounts from 5 miles up, to contractors. Road and hghwy. comrs., Marion, S. C.

Knoxville, Tenn.—The city is contemplating paving constructions to cost about $50,000.

Brownsville, Tex.—A committee of ladies of the Civic League have raised money to pay for oiling the city streets.

Dallas, Tex.—The city contemplates paving Columbia avenue with bitulithic, $61,256.

Ft. Worth, Tex.—The Roach-Manigan Paving Co., of Memphis, Tenn., has been incorporated in Texas for the capital stock of $98,000.

Hamlin, Tex.—Paving of several streets with macadam roadway is contemplated. P. E. Fraser.

San Antonio, Tex.—The county commissioners have decided upon a system of oiling for the macadam roads in Bexar county.

Salt Lake, Utah.—The board of supervisors has appropriated $240,000 for street and sewer work. G. F. McGonagle, cy. engr.

Alexandria, Va.—City Engineer Dunn is planning to pave N. Alfred and a number of other streets.

Tacoma, Wash.—The city commission has ordered the improving of Tacoma avenue, $21,922.

Morgantown, W. Va.—The county court has authorized Engineer Hennen to grade and gravel three-quarters of a mile of highway near Tin Mill.

Antigo, Wis.—The city council has appropriated $11,000 for a highway from Arbor Vitae to Hacklet.

Eau Claire, Wis.—The city council has passed ordinances for the construction of macadam pavement and brick gutters on Marston avenue, and sewers on Broadway.

Milwaukee, Wis.—Paving contracts have been awarded to the following firms: Badger Construction Co., Milwaukee, and R. F. Conway.

Toronto, Ont.—Victoria street will be extended at a cost of $315,000. Civic com. on wks.

Santos, Brazil, S. A.—The American consul reports that bids will be received November 12th at Rio Grande for water works, paving and drainage; and on November 14th by the city of Pelotas for electric light and power works.

SEWERS.

BIDS REQUESTED.

Lexington, Miss.—Oct. 18. Constructing 5½ miles of 6 to 12 in. pipe sewers. W. G. Kirkpatrick, engr., Jackson, Miss.

Elizabeth, N. J.—Oct. 2, 8 p. m. Constructing sewers as follows: 777 ft. 10 in. piper sewer, manholes and appurtenances. Bond 25 per cent. N. J. Thompson, st. comr.

Newburg, N. Y.—Oct. 3. Constructing sewer in Broadway, estimated to cost $3,300; constructing sewer in Water st., estimated cost, $350. City Engineer Blake.

Fargo, N. D.—Oct. 2, 5p. m. Constructing 12 in. lateral sewer on Fifth street. E. R. Orchard, audt.

Muskogee, Okla.—Oct. 3, 10 a. m. Constructing brick and vitrified pipe sewers. Certified check $100. Charles Wheeler, Jr., cy. clk.

Pittsburg, Pa.—Oct. 3, 10 a. m. Constructing sewers on Levan alley and McConnell avenue; constructing 48 in. and 52 in. concrete sewer, 4,400 ft., 6 to 15 in. terra cotta pipe sewer, 9,250 ft. on Wabash and other streets. Joseph G. Armstrong, dir. of pub. wks.

Madison, S. D.—Oct. 5. Constructing a sewage disposal plant. William Rae, cy. audt.

Dallas, Tex.—Oct. 6, 3 p. m. Constructing sewers in 4 streets. Will be from 15 in. vitrified pipe to 80 in. plain concrete. Certified check, $500. J. B. Winslett, cy. sec.

Huntington, W. Va.—Oct. 5, 1 p. m. Constructing 10 and 12 in. pipe sewers in five streets. Certified check, $500 on each bid. John Coon, comr. of sts., A. B. Maupin, cy. engr.

Hungtington, W. Va.—Oct. 5, 1 p. m. Sewer construction as follows: 10 in. tile sewer in alley between Nineteenth and Twentieth; 12 in. tile sewer in alley between Elm and Seventeenth; 12 in. tile sewer in alley between Seventh and railway right-of-way; 12 in. swere in alley between Jefferson and Madison. Certified check, $500 on each bid. John Coon, comr. of sts.; A. M. Maupin, cy. engr.

Huntington, W. Va.—Oct. 5, 1 p. m. Constructing 10 and 12 in. pipe sewers on five streets. Certified check, $500. John Coon, comr. of sts.; A. B. Maupin, cy. engr.

Powell, Wyo.—Oct. 2, 2 p. m. Constructing ditches, including 179,000 cu. yds. of excavation and 2,000 lin. ft. of wooden box culverts. F. H. Newell, dir.

CONTRACTS AWARDED.

Anaheim, Cal.—Constructing municipal sanitary sewer system, to Chamberlain, Williamson & Chamberlain, 998 E. Union St., Pasadena, $26,5000. Contract for furnishing the pipe was let to the Pacific Sewer Pipe Co., Los Angeles, at $14,963.

Coronado, Cal.—Sewer construction, to Watson & Spicer of Los Angeles. $26,587.

Lindsay, Cal.—Constructing sewer system, to Chambers & Heafy, San Francisco, $59,650.

Los Angeles, Cal.—Constructing 8 to 10 in. pipe sewer to the Frick Construction Co.

Pacific Grove, Cal.—Constructing sewers, to C. D. Vincent, Oakland, Cal., $21,306.

San Francisco, Cal.—Constructing North Point main sewer, to F. Rolandi, $130,000.

Washington, D. C.—Constructing sewers in Massachusetts Heights, to Warren F. Benizer, Washington, D. C., $33,800.

Waukegan, Ill.—Constructing North Side sewer, to John Brogan, Green Bay, Wis., $25,743.

Galveston, Ind.—Constructing two sanitary sewer systems, Lee & Everroad, Columbus, Ind., $5,756.

Mason City, Ia.—Constructing sewers to F. R. Bowen of Mason City.

Oelwein, Ia.—Constructing sewers on First, Fourth and Sixth avenues and First street, to R. C. De La Hunt, Cedar Rapids, Ia.

Webster City, Ia.—Contract for constructing 4,420 ft. of sewers have been let to the following firms: Sullivan & Vitterell, Garbernick & Anderson, and the Mid-West Engineering Co.

West Liberty, Ia.—Constructing six miles of sewers and disposal plant, to the Lythe Construction Co., Sioux City, Ia.

Wichita, Kas.—Extension of the Wichita drainage canal and storm sewer, to the Pollard-Campbell Dredging Co., Omaha, Neb., $22,088.

Wichita, Kas.—Constructing Sanitary Sewer No. 20, to John Striffler, Wichita, Kas.

Boston, Mass.—Constructing catch basins, to J. H. Ferguson & Co., $4,550.

Fitchburg, Mass.—Constructing intercepting sewer, to Little & Serretto of Leominster, Mass., $57,073.

Duluth, Minn.—Constructing sewers and water mains on Elba avenue, to the Pastoret-Lawrence Co., $10,000.

Springfield, Mo.—Constructing sewers in district No. 5, to the Will F. Plummer Paving Co., $1,003.

Shelbina, Mo.—Constructing sewerage system, septic tank, etc., to Goodwin & Ryan of Springfield, Ill., $6,209.

Great Falls, Mont.—The following sewer contracts have been awarded: Seventh alley, to F. E. Evans, $3,414; Second alley, to Nilson-Smith Co., $893.

Binghampton, N. Y.—Constructing sewer in First ward, to David Tumpusky, $8,462.

New York, N. Y.—Constructing sewers in the Borough of Queens, to William Kelly, $66,740.

Yonkers, N. Y.—Constructing first section of the Nepperhan Valley sewer, Hugh McDonald and Murray, Yonkers, N. Y., $103,839.

Fargo, N. D.—Constructing 6,780 ft. of sewer, to L. W. Schruth, Fargo, $13,261.

Hillsboro, N. C.—Constructing sewers, to Carroll & Son of Grand Fork, $7,000.

Findlay, O.—Constructing E. Findlay sewer, to Fred Kleinman, $11,150; constructing Logan avenue sewer, to the Hancock Stone Co., $1,398.

Fremont, O.—Cleaning and improving Silver creek, to Henry Hughes & Sons, Millersville, $15,000.

Altoona, Pa.—Constructing sewers to Fogle & Co., Hollidaysburg, Pa., $14,925.

Aroca, Pa.—Constructing sewers, to P. T. McGowan & Son of Scranton, Pa., $1,755.

Erie, Pa.—The following sewer contract has been awarded: 9 inch sewer in Second street, to Joseph McCormick & Bro.

Lebanon, Pa.—Constructing sewers, to the Central Construction Co., Parkersburg, W. Va., $70,000.

St. Elmo, Tenn.—Constructing the first part of the sewer system, to the B. F. Meeks Co., Atlanta, $8,000.

Brownsville, Tex.—Constructing storm sewer, to M. E. Rendall.

El Paso, Tex.—Constructing 1,100 ft. of 24 in. pipe sewer, to the San Antonio Pipe Co., San Antonio, Tex.

Salt Lake City, Utah.—Constructing gravity outlet sewer, to Raleigh & Harmon, $11,000.

Kent, Wash.—Constructing lateral sewer, to H. T. Barnes, $10,500.

Seattle, Wash.—The following sewer contracts have been awarded: Dexter avenue sewer, to T. Ryan, Sullivan Bldg., Seattle, $7,017; Dexter avenue paving, to J. Ruthe, 131 W. Tilbourne street, Seattle, $3,711.

Kenosha, Wis.—Constructing sewer in Ashland avenue, to Michael Steinbach.

Racine, Wis.—Constructing Blue River sewer, to Jas. Cape & Sons, $7,200.

New Westminster, B. C.—Constructing West End sewer system, to the Sinclair Construction Co., $79,575.

CONTEMPLATED WORK.

Nogales, Ariz.—A $50,000 bond issue for a sewer system has been voted.

San Francisco, Cal.—The board of supervisors has set aside $240,000 for the street work, including sewers, during the period from September 1 to December 31.

Willows, Glenn County, Cal.—The city has voted bonds for the construction of sewers. City trustees.

Wilmington, Del.—The city council has appropriated $30,000 for special sewer work.

Jacksonville, Fla.—The board of bond trustees has been ordered to lay sewers in Monroe street. W. W. Swain, chairman.

Lawrenceville, Ga.—A $50,000 bond issue for water works and sewer system has been voted. J. B. McCrary Co., Empire Bldg., Atlanta, Ga., engrs.

Terre Haute, Ind.—The city is contemplating sewer constructions to the amount of $100,000.

Waterloo, Ia.—The city council has ordered the construction of sewers in West Mullen avenue.

Wichita, Kan.—The city is contemplating sewer extensions to cost about $300,000.

Lexington, Ky.—The city is contemplating the construction of a sewage disposal plant to cost $150,000.

Louisville, Ky.—The board of public works is considering the construction of a 54-in. concrete sewer on M street; estimated cost, $40,000. Marshall W. Neal, chrmn., bd. pub. wks.

Opelousa, La.—A $40,000 bond issue for construction of sewerage system has been voted.

Brookhaven, Miss.—The city is contemplating the installation of a sewer system to cost about $20,000.

Doniphan, Mo.—Plans are being prepared for a sanitary sewer system for this place.

Rosedale, Mo.—The firm of Burns & McDonnell, consulting engineers of Kansas City, have been retained to draw plans for a$100,000 swer system.

St. Joseph, Mo.—The city is contemplating the construction of a storm water drainage system to cost about $12,000.

Anoka, Minn.—The state has appropriated $16,000 for the construction of a sewer from the asylum down Fourth avenue.

Las Cruces, N. M.—The city has voted $75,000 worth of bonds for sewer system and water works plant.

Albia, N. Y.—City Engineer Grimes has the complete plans for sanitary sewer system.

Rochester, N. Y.—The common council has authorized an appropriation of $30,000 for a new outlet sewer in West avenue; also swers in Parkway and Coster streets, $45,000; and various street pavements. William Ward, cy. clk.

Schenectady, N. Y.—The city is contemplating the construction of several new sewers.

Middletown, O.—The city council has authorized the construction of sewers in Elwood, George and Hughes streets. John Kunz, cy. clk.

Sebring, O.—The village council have authorized the construction of a sewer in California avenue. Harry Jenkins, clk.

Senecaville, O.—The city is contemplating installation of sewerage and water works system, to cost $40,000. H. L. Maddocks, Newark, O., engr.

Steubenville, O.—The city council has authorized the construction of a sewer between

Seventh and Eighth streets. Hugh W. Patterson, clk.

Muskogee, Okla.—The city council has ordered the construction of sewers in district No. 63. Chas. Wheeler, Jr., cy. clk.

Springfield, Ore.—The city has voted $100,000 bonds for constructing sewers, macadamizing streets, etc.

Beaver Falls, Pa.—The city is contemplating the construction of a storm sewer on Sixteenth street.

Connellsville, Pa.—Chester & Fleming, consulting engineers, Pittsburg, Pa., have been retained to prepare plans for sewage disposal plant. J. B. Bogg, cy. engnr.

Dravosburg, Pa.—The borough will construct a new sewerage system in compliance with the order of the state health department.

Erie, Pa.—The city engineer has been instructed to advertise for bids for sewer on Short street.

Lancaster, Pa.—The city has been notified by the state health department that a sewage disposal plant must be constructed.

Lansdale, Pa.—The city is contemplating the construction of a sewage disposal plant to cost $75,000.

McKees Rocks, Pa.—The town council has ordered the construction of a sewer in Helen street. John S. Pastre, sec.

Monnessen, Pa.—The town council has ordered the construction of a sewer in Tenth street. J. E. Pittman, sec.

New Brighton, Pa.—The city is contemplating the construction of a sewer system to cost about $10,000. Leo Hudson, engnr.

New Kensington, Pa.—Morris Knowles of Pittsburg, Pa., has been retained to prepare plans and estimates for a sewage disposal plant.

Port Carbon, Pa.—The borough is contemplating sewer construction to cost about $20,000.

Woonsocket, R. I.—The sum of $4,480 has been appropriated for sewer construction.

Dillon, S. C.—The city has voted $39,000 worth of bonds for sewerage improvements.

Aberdeen, S. D.—The city has employed W. G. Porter, Chicago, to superintend the construction of sewer and water works systems.

Marysville, Tenn.—The construction of a sewerage system to cost $30,000 is contemplated.

Brownsville, Tex.—Bids received Aug. 30 for construction of a drainage system were rejected. New bids will be received Oct. 3. Drainage Comrs.

Bryan, Tex.—A $20,000 bond issue for water works, sewers and electric light plant has been voted.

Dallas, Tex.—Street commissioner Lee has recommended the construction of a storm sewer to cost $33,617.

Salt Lake, City, Utah.—The board of supervisors has appropriated $240,000 for street and sewer work. G. F. McGonagle, cy. engnr.

Williamsburg, Va.—The city is contemplating the installation of water works and sewerage system.

Auburn, Wash.—The city has voted $15,000 bonds for a new reservoir and sewer outlet.

Spokane, Wash.—A sewer district for subtrunk sewer in the First ward has been organized.

Fairmont, W. Va.—The Outlook Farms Co., of this city, has been incorporated to construct sewers, build electric light plants, etc. Capital, $15,000. Incorporators: J. M. Hartley, W. J. Wiegel, Glenn F. Barns, N. M. Neeley, and H. S. Lively.

Parkersburg, W. Va.—The city is contemplating the construction of sanitary sewers on Liberty and Gale streets.

Eau Claire, Wis.—The city council has authorized the construction of a sewer in Broadway. J. C. Fennessey, cy. clk.

WATER WORKS.

BIDS REQUESTED.

Lexington, Miss.—Oct. 18. Constructing water works system, including 2 flowing artesian wells, reservoir, steel tank and tower, steam and gasolene driven pumps, boilers and 6 miles of 6 to 10 in. cast iron water main with all hydrants, valves, etc. W. G. Kirkpatrick, engr.

Pittsburg, Pa.—Oct. 3, 10 a. m. Constructing 7,000 lin. ft. 6 to 12 in. water pipe. Jos. D., dir. of pub. wks.

CONTRACTS AWARDED.

Coronado Beach, Cal.—Furnishing 16-in. cast iron water pipe and fittings for improving the water system, to Hazard-Gould Co., Birmingham, Ala., at $135,000.

San Francisco, Cal.—Constructing fire protection pipe line, $110,500; also pumping station No. 1, to the Healy, Tibbitts Company.

Jacksonville, Fla.—Drilling artesian wells, to the Southard Contracting Co., and the Ohio Well Drilling Co.

Cherry, Ill.—Constructing 2,700 ft. of water main to J. M. Dougherty of Ottawa, Ill.

Cherokee, Ia.—Constructing water works extension, to the Mid-West Engineering Co., Omaha, Neb.

Athol, Mass.—Furnishing and laying 9,000 ft. of 12-in. pipe, to J. M. Dineen & Son, Easthampton, Mass.

Newton, Mass.—Constructing concrete well, 28 ft. in diam. by 38 ft. deep, to T. Stuart & Son Co., $8,900.

Beulah, Mich.—Constructing dam for water works, to Small & Sinclair, of Bentonia, Mich.

Eveleth, Minn.—Installing water main on Hayes street, to the Pastoret-Lawrence Co., Duluth, at 61 cts. per ft. for 4-in. pipe; $19.50 each for hydrants; 5 cts. per lb. for specials; $9 per. cu. yd. for rock excavation, and $1 per cu. yd. for earth.

Shakopee Minn.—Sinking deep well, laying water mains and erecting a standpipe, to J. G. Robertson, St. Paul, $8,452.

Clarksdale, Miss.—Extending water works system to J. C. Mishler, of Chattanooga, Tenn.

Kansas City, Mo.—Installing water tube boilers at the Turkey Creek and Quindaro pumping stations, to the English Tool & Supply Co., at $29,610.

Shelbina Mo.—Constructing water works system, to the Des Moines Bridge & Iron Works of Des Moines, Ia., $66,000.

Harlem, Mont.—Constructing water works, to the American Light & Water Co., Chicago, $30,940.

Manhattan, Mont.—Constructing water works system, to Linstran & Owen, Billings, at $19,757.

Brainerd, Neb.—Constructing water works, to C. F. Robeck, Aurora, Neb., $15,000.

Bridgeport, Neb.—Constructing water works, to C. A. Newberry, Alliance, $6,092.

Geneva, N. Y.—Constructing filtration plant and reservoir, to the Lake Shore Construction Co., Dunkirk, N. Y., $60,000.

Ithaca, N. Y.—The following contracts have been awarded: 600,000 gallon reservoir, to the Chicago Bridge & Iron Works, Chicago, Ill., $6,600; 150,000 gal. tank, to the Dover Boiler Works, of New York, $3,445.

Bismarck, N. D.—The following contracts have been awarded: Steel tank, to Grams & Peet, of Bismarck, $3,597; constructing wells, to G. M. Beers & Son, of Bismarck; constructing steel tank, to Grams & Peet.

Cincinnati, O.—Laying water mains, to M. F. Quill, Cincinnati, $12,000.

New Lexington, O.—Constructing water

works system has been let to the National Co., of South Bend, Ind., at $44,000.

Soper, Okla.—Constructing water works system, to H. S. Sherman; estimated cost, $13,000.

Astoria, Ore.—Constructing 100,000,000-gal. concrete reservoir dam ($64,890), and cleaning the site ($10,000), to Bidwell Hayden & Co., Portland.

Columbia, Pa.—Constructing a 1,000,000-gal. impounding basin for the York Water Co., to Stamper, Ragland & Co., Richmond, Va., $200,000.

York, Pa.—Constructing the billion-gal. impounding basin for the York Water Co., to Spanter, Ragland & Co., of Richmond, Va.

Seattle, Wash.—Laying Twenty-sixth street water main, to the Washington Construction Co., $5,638.24.

Wheeling, W. Va.—Constructing water works distribution system, to W. J. McPlain; furnishing pipe to the U. S. Cast Iron Pipe & Foundry Co., of Pittsburg, Pa.

Burnaby, B. C.—Laying water pipe, to W. A. Kennedy, West Vancouver, $94,952.

Toronto, Ont.—Constructing 500-ft. extension of the water works intake, to Miller, Cumming & Robertson, Toronto.

CONTEMPLATED WORK

Walnut Ridge, Ark.—The city has voted to construct water works.

Redlands, Cal.—Construction of an auxiliary high pressure water system to cost $50,000, is contemplated.

Sisson, Cal.—The city has voted to issue $45,000 bonds for constructing municipal water and sewer systems.

Milliken, Colo.—The city has voted $15,000 bonds for additional water works.

Palmetto, Fla.—The city has voted $20,000 bonds for the construction of a water works system.

Jackson, Ga.—A $12,000 bond issue for water works construction and the extension of the electric light plant has been voted.

Jessup, Ga.—Arthur Pew, consulting engineer, Eastman, Ga., has been retained to prepare plans for construction of water works to cost about $25,000.

Lawrenceville, Ga.—A $50,000 bond issue for water works and sewer system has been voted. J. B. McCrary Co., Empire Bldg., Atlanta, Ga., engrs.

Bement, Ill.—Water works extension, to cost $7,800, are contemplated.

Clinton, Ind. Bids are being received for constructing a 16-in. suction water pipe system. W. R. Paige, Rose Dispensary Bldg., Terre Haute, engr.

Casey, Ia.—A $14,000 bond issue for water works construction has been voted. E. A. Betts, town clk.

Council Bluffs, Ia.—The city contemplates building a 10,000,000-gal. settling basin. Burns & McDonnell, Kansas City, engrs.

Pierson, Ia.—Plans are being prepared for the construction of a water works system.

Chapman, Kan.—The construction of a water works system, to cost $25,000, is contemplated. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., engrs.

Hill City, Kan.—The city has voted to build water works and an electric light system.

Roseland, La.—The town has voted to construct a water works system. J. M. Chapen, mayor.

Cumberland, Md.—The Evitts Creek Water Co. has been incorporated, with a capital stock of $500,000, for the purpose of constructing a water works system. Thomas Footer, pres., and D. Lindley Sloan, sec.

York, Md.—The York Water Co., contemplates building a 1,000,000-gal. reservoir.

Boston, Mass.—Bids will be received for laying 3,600 lin. ft. of water pipe in various streets. Louis K. Rourke, com. of pub. wks.

Stanton, Mich.—The city has voted $10,000 bonds for the construction of water works and an electric light plant.

Baraga, Minn.—The village has voted $30,000 bonds for light and water plants.

St. Paul, Minn.—The city is contemplating the construction of two reservoirs, to cost about $250,000.

Campbell, Mo.—A $22,000 bond issue for construction of water works system has been voted.

Kirkwood, Mo.—The city has voted $10,000 bonds for improving the water works and electric light plant.

Montgomery, Mo.—The city has voted $20,000 bonds for constructing water works and sewers.

Princeton, Mo.—A $7,000 bond issue for water works and electric lighting extensions has been voted.

Bethany, Neb.—The village has voted $20,000 for the construction of water works.

Oakdale, Neb.—Bonds for the extension of the water works system have been voted.

Shelby, Neb.—A $15,000 bond issue for the installation of water works system has been voted.

Union, Neb.—The city is contemplating the construction of a water works system.

Portsmouth, N. H.—The city is contemplating water works extensions. J. E. Parker, supt.

Jersey City, N. J.—The city has decided to purchase a new water works at Boonton, N. J.

Las Cruces, N. M.—The city has voted $75,000 worth of bonds for sewer and water works plant.

Tucumcaria, N. M.—This city will erect a fire house and a 100,000-gal. steel tower.

Yonkers, N. Y.—Allen Hazen, New York., consulting engineer, has recommended the construction of two covered filter beds and the installation of a ten million gallon pump at the city water plant. J. A. Brady, Comr. of pub. wks.

Mott, N. D.—A $10,000 bond issue for fire apparatus and water works system is contemplated.

Bellaire, O.—The city has voted $14,000 bonds for additional water mains.

Cincinnati, O.—Supt. Laidlaw has requested $1,225,553 for the maintenance of the water works department during 1912.

Cleveland, O.—The F. A. Pease Engineering Co., 930 Williamson Bldg., have prepared plans for 14 miles of water mains, to cost about $80,000.

Fairview Heights, O.—G. Frank Gates has been retained to prepare plans for a water works for the village.

Fredericktown, O.—The installation of electrically driven pumps in the municipal water works plant is contemplated. Electricity will be furnished by the Mt. Vernon (O.) Electric Co.

Sebring, O.—Chester & Fleming, Pittsburg, Pa., have been retained to prepare plans and specifications for additional pumping machinery.

Senecaville, O.—The city is contemplating installation of sewerage and water works system, to cost $40,000. H. L. Maddocks, Newark, O., engr.

Wainwright, O.—The city has voted $20,000 bonds for the construction of a water works system.

Dustin, Okla.—A $25,000 bond issue for constructing a water works system has been voted.

Hobart, Okla.—The city has voted $30,000 for extending the water works. C. G. Long, mayor.

Norman, Okla.—A $12,500 bond issue for water works extension has been voted.

Stillwater, Okla.—A $15,000 bond issue for water works extension has been voted.

Wagoner, Okla.—The Benham Engineering Company of Oklahoma City, Okla., has been

retained to make the plans for the water works and electric light extension to cost about $40,000.

Barnesboro Pa.—The Citizens Water Co. has been organized to supply the town from wells.

Brookville, Pa.—The city has purchased the plant of the local water company.

Gettysburg, Pa.—The water company will install a new filtration plant; estimated cost, $30,000.

Homestead, Pa.—Chester & Fleming, Pittsburg, Pa., have been retained to prepare a report on the local water works system.

Huntingdon, Pa.—The city is contemplating the replacing of a wooden dam with a concrete structure.

North Manadim, Pa.—The Wayne Water Company has been organized for the purpose of building a water works plant for the town. The following are interested: J .C. Freeland, Philadelphia ,Pa.; S. H. Treat, C. L. Van Schaick, T. J. Grayson, of Wayne, Pa.

Dillon, S. C.—The city has voted $38,000 worth of bonds for water improvements.

Aberdeen, S. D.—The city has employed W. G. Porter of Chicago to superintend the construction of sewage disposal works and a 600,000-gal. stand pipe for the water works system.

Dayton, Tenn.—The city is contemplating the construction of water works, to cost $24,560. W. G. Kirkpatrick, Jackson, Miss., engr.

Alice, Tex.—The city has voted $20,000 bonds for construction of water works.

Brady, Tex.—The city has voted to issue bonds for $40,000 for a water works system.

Bryan, Tex.—A $20,000 bond issue for water works, sewers and electric light plant has been voted.

Hillsboro, Tex.—A $15,000 bond issue for water works extension has been voted.

Timpson, Tex.—The city has voted $20,000 bonds for water works construction.

Perry, Utah.—The city has voted $10,000 bonds for construction of water works.

Wiliamsburg, Va.—This city is contemplating installing of water works and sewerage system.

Asotin, Wash.—The town has voted to issue bonds for $35,000 for installing a water works system.

Auburn, Wash.—A $6,000 bond issue for construction of a new reservoir has been voted.

Brewster, Wash.—The city has voted bonds for the construction of water works.

Burlington, Wash.—The construction of a water works system is contemplated.

Centralia, Wash.—Tentative plans have been prepared for constructing a water works system; estimated cost, $115,000.

Ellenburg, Wash.—A $100,000 bond issue for water works construction has been voted.

Grandview, Wash.—Plans have been prepared for a water works system; estimated cost, $20,000.

Pleasant Valley, W. Va.—Chester & Fleming, engineers, Pittsburg, Pa., have been employed to make a survey and report for a water works system for the village.

Manitowoc, Wis.—The city has voted bonds for the purchase of the water works system.

Santos, Brazil, S. A.—The American Consul reports that bids will be received Nov. 12 at Rio Grande for water works, paving and drainage; and on Nov. 14 by the city of Pelotas for electric light and power works.

BRIDGES.

BIDS REQUESTED.

Decatur, Ind.—Oct. 5, 10 a. m. Constructing several cement bridges. H. F. Michaud, audt.

Fowler, Ind.—Oct. 3, 1 p. m. Constructing 27 bridges, culverts, etc. Lemuel Shipman, audt.

Greenfield, Ind.—Oct. 2, 10 a. m. Constructing and repairing a number of bridges. Charles H. Troy, audt.

Hartford City, Ind.—Constructing cement culvert in Harris township. James Cronin, Jr., audt.

Marion, Ind.—Oct. 3, 2 p. m. Constructing bridges in Grant county. A. Y. Stout, audt.

Bermuda, La.—Oct 4, 12 m. Constructing steel highway bridge. C. E. Crudhomme, pres. pol. jy.

Cincinnati, O.—Oct. 13, 12 m. Constructing bridges over Bull Run, Forfeit Run and Eagle creek. Bond, $500 on each bid. Fred Dreihs, clk for the Hamilton co. comrs.

Cleveland, O.—Oct. 7. Constructing concrete bridge under report No. 2869, and concrete bridge under report No. 2870. Certified check, 10 per cent. John F. Goldenbogen, clk.

Cleveland, O.—Oct. 7, 11 a. m. Constructing concrete bridge on Eagle road. Certified check, 10 per cent. John F. Goldenbogen, clk.

Washington, Ind.—Oct. 7, 10 a. m. Constructing bridges in Harrison, Barr and Washington townships. Thomas Nugent, audt.

Clearfield, Pa.—Oct. 7, 12 m. Repairing steel bridge over Chest creek. Certified check, $100. L. C. Norris, clk. co. comrs.

CONTRACTS AWARDED.

Success, Ark.—Constructing a steel highway bridge over Little Black river, to the Vincennes Bridge Co., Vincennes, Ind.

Harrison, Ark.—Constructing 200-ft. steel bridge, to the Dallas Construction Co., Dallas, Tex.

Oroville, Cal.—Constructing bridge, to the Ross Construction Co., $47,500.

Redding, Cal.—Constructing bridge over Cow creek, to D. F. Bennett, $2,660.

Michigan City, Ind.—Constructing steel bridge, to the Rochester Bridge Co., $4,832.

Mason City, Ia.—Constructing steel girder bridge, to the Illinois Steel Bridge Co., $4,715.

Waterloo, Ia.—Constructing Sans Souci bridge, to the Miller-Hey Constructing Co., Waterloo, $8,880.

Natchitoches, La. — Constructing three bridges, to Bostun & Quin, Natchitoches, $4,450.

Grand Rapids, Mich.—Constructing the concrete bridge at Leonard street, to the Hackedorn Contracting Co., Indianapolis, $77,777.

Albert Lea, Minn.—Constructing a concrete bridge and dam at Fountain Lake, to the Marsh Engineering Co., Des Moines, Ia., $25,475.

Maple Plain, Minn.—The following bridge contracts have been awarded: Thomas Contracting Co., $1,163; to Geo. Turnham, $900; to the Minneapolis Steel & Machinery Co., $886 and $916.

Nebraska City, Neb.—Constructing Eleventh and Ninth street bridges, to J. A. Nelson, of Nebraska City.

Irving, N. Y.—Constructing bridge over Cattaraugus creek has been awarded to the Owego Bridge Co., of Owego, N. Y., $11,128.

South Hampton, N. Y.—Constructing bridge, to the Groton Bridge Co., $10,189.

White Plains, N. Y.—Constructing bridge over Croton river, to Irving De Revere, North Tarrytown, $5,800; constructing bridge over Byram river, to Robert J. McKeon, of White Plains, $3,995.

Cleveland, O.—Repairing Central viaduct: Paint, to Antonio Glaros; piers, to the Great Lakes Dredge & Dock Co.; track stringers, to the Republic Steel & Iron Co., piers 39 and 40, to the Wm. Kupper Construction

Co.; swing stand, to the King Bridge Co.; lubricating oil, to the Standard Oil Co. Total, $226,000.

Hamilton, O.—Constructing bridge over Tallawanda creek, to the Oregonia Bridge Co., $9,600.

Waverly, O.—Constructing 120-ft. steel bridge, to the Oregonia Bridge Co., of Lebanon, O., $3,470.

Hugo, Okla.—Constructing 27 bridges, to the Midland Bridge Co., Kansas City, $115,000.

Blairsville, Pa.—Constructing concrete bridge, to the Ferro Concrete Co., of Harrisburg, Pa., $8,145.

Doylestown, Pa.—Constructing concrete bridge over Cook's creek at Funk's Mill, to the Riegelsville Construction Co., $6,000.

Mars, Pa.—Constructing bridge, to Tony Morelli, of Butler, Pa.

North Braddock, Pa.—Constructing steel bridge and stairway at Thirteenth street crossing, to Penn Bridge Co., Beaver Falls, Pa.

Philadelphia. Pa.—The following bridge contracts have been awarded: Reinforced concrete arch bridge, to Sigasoof & Poore, of Rievelsville, Pa., $3,046; concrete bridge, over Adams Hollow creek, to Costello & Co., of Philadelphia, $5,550.

Reading, Pa.—Constructing new Copton bridge, to Fehr and O'Rourke, of Reading, $1,346.

West Chester, Pa.—Constructing a stone bridge over Brandywine creek, to the Cortoran Construction Co., of West Chester, $17,953.

West Fairview, Pa.—Constructing bridge, to the Martin Stone Quarries Co., $3,949.

Sioux Falls. S. D.—Constructing concrete bridge, to the N. M. Stark & Co., of Des Moines, Ia., $45,000.

Charleston, Tenn.—Constructing steel bridge over the Hiwassee river, to the Virginia Bridge & Iron Co., of Roanoke, Va., $21,975.

Haskell, Tex.—Constructing two bridges across the Brazos river, to Austin Bros., Dallas, $16,012.

Wheeling, W. Va.—Constructing the Morris concrete bridge, to Henry Neihardt & Son, Bellaire, O.

CONTEMPLATED WORK.

Birmingham, Ala.—Plans have been prepared for the new highway bridge over the Warrior river. The structure will be of steel. Estimated cost, $15,000.

Marysville, (Yuba County), Cal.—The county is planning to raise and strengthen the D street bridge. Leslie Crook, co. engr.

Pasadena, Cal.—The city is contemplating the construction of a bridge across the Arroyo Seco, to cost about $200,000. Waddell & Harrington, Kansas City, Mo., engrs.

San Bernardino, Cal.—Bids will soon be asked for the construction of a steel bridge over Santa Ana river.

Denver, Colo.—The construction of a bridge at West Alameda is contemplated, to cost about $31,000.

Decatur, Ill.—County Surveyor Hicks has recommended the replacing of the Franklin street bridge with an $18,000 steel bridge.

Elkhart, Ind.—County commissioners are considering the construction of a bridge over St. Joseph river on Elkhart avenue. Estimated cost, $45,000.

Newport, Ind.—The county council has made the following appropriations: For the Army Ford bridge, $14,000; for Purilletts creek bridge, $14,000; for bridge repairs, $5,000.

Richmond, Ind.—The Wayne county commissioners have decided to construct a bridge over the White Water river to cost between $75,000 and $100,000.

Davenport, Ia.—The construction of a stone bridge at Second street is contemplated. Clark D. Anderson, comr.

Dodge City, Kan.—Construction of three reinforced concrete bridges on the New Santa Fe Trail is contemplated.

Hutchinson, Kan.—The county commissioners have ordered the construction of three concrete bridges along the Santa Fe Trail.

Wichita, Kan.—The city is contemplating the construction of a concrete arched bridge over the drainage canal. Burt B. Wells, cy. engr.

Boston, Mass.—The metropolitan park commission is planning to construct a bridge across the Charles river. John R. Rablin, ch. engr.

Vicksburg, Miss.—The city and county contemplate the construction of a reinforced concrete bridge over Glass Bayou, $13,000. H. J. Trowbridge, cy. clk.

Dolgeville, N. Y.—A $3,500 appropriation for construction of a bridge has been voted.

Moravia, N. Y.—The village has voted to build a new bridge over Owasco creek.

Chandler, Okla.—The county commissioners contemplate spending $30,000 in the repair and construction of bridges.

Blairsville, Pa.—The county commissioners are planning to re-build the McCormick bridge in three reinforced concrete arches, 203 ft. long altogether.

Brownsville, Pa.—The commissioners of Fayette and Washington counties will construct a $160,000 bridge. Chaney & Armstrong, of Pittsburg, Pa., engrs.

York, Pa.—The plan of the York Sanitary Reduction Co. has been destroyed by fire. A new plant will be constructed. E. F. Brooks, sec.; Chas. B. Fishcer, gen. mgr.

Sommerville, Tenn.—The county is planning to construct seven steel highway bridges. Howard M. Jones, Nashville, engr.

Houston, Tex.—Plans for a reinforced concrete bridge over the White Oak Bayou have been approved and bids will be requested soon. F. L. Dormant, cy. engr.

Appleton, Wis.—The Outagamia county board of supervisors are considering the construction of a steel bridge over the Fox river at Kimberly, to cost $25,000.

STREET LIGHTING.

CONTRACTS AWARDED.

Phoenix, Ariz.—Installing an ornamental street lighting system, to J. C. Corbin & Co., Seattle, Wash., $23,000.

South Norwalk, Conn.—Enlargement of the gas plant of the Housatonic Power Co., to the United Gas Improvement Co., Philadelphia, Pa.

Newport, Ky.—Supplying electricity for city lights, to the Union Light, Heat & Power Co.

Florham Park, N. J.—Furnishing street lights, to the Morris & Somerset Electric Co., Morristown.

Bismarck, N. D.—Installing 128 ornamental lamp posts, to Grambs & Peet, $12,157.

Masontown, W. Va.—A franchise has been granted to the Preston County Coke Co. to furnish the city with electric light and power.

Warwood, W. Va.—Furnishing street lights, to the Sun Vapor Street Light Co.

Minocqua, Wis.—Installation of a lighting system, to the Central Construction Co., of Oshkosh, at $7,500.

CONTEMPLATED WORK.

Arlington, Cal.—The city contemplates installing an ornamental street lighting system.

Pasadena, Cal.—New bids will be asked for installing ornamental electric lighting posts and wiring on South Orange and Colum-

bia streets. Bids recently submitted were returned unopened.

Bowlder, Colo.—A municipal power plant is being considered.

Jackson, Ga.—A $12,000 bond issue for water works construction and the extension of the electric light plant has been voted.

Peru, Ind.—An appropriation of $12,000 for the installation of an ornamental lighting system has been voted.

Worthington, Ind.—The Indiana Light & Power Co.'s plant has been purchased by W. H. Yule.

Colfax, Ia.—The Colfax Electric Light Co. is planning to extend its system to Prairie City.

Coon Rapids, Ia.—The city is contemplating the installation of a three light electrolier lighting system.

Corydon, Ia.—The city is planning the destruction of the electric light system, including new engines, generators, boiler, etc. J. J. E. Fowler, town clk; Iowa Engineering Co., Clinton, Ia., engrs.

Davenport, Ia.—Merchants on West Third street are contemplating an ornamental lighting system. Address, Geo. H. Martin. Current is furnished by the Peoples Light Co.

Abilene, Kan.—The city is contemplating the installation of an ornamental light system which will include about 175 posts.

Hutchinson, Kan.—Contract for furnishing current for street lights has been awarded to the United Water & Gas C. An ornamental street lighting system will be installed.

La Cygne, Kan.—Plans have been prepared for the construction of an electric light plant and water works system; estimated cost, $30,000.

Ness City, Kan.—The city has voted $16,000 bonds for the construction of an electric light plant. J. G. Collins, cy. clk.

Newburyport, Mass.—The directors of the Newburyport Gas and Electric Co., have completed plans for additional electrical equipments.

Baraga, Mich.—Plans are being prepared for an electric light and water works system; estimated cost is $30,000.

Port Huron, Mich.—The Port Huron Light & Power Co. has been purchased by James E. Lynn. D. N. Gurney of Detroit is secretary and J. D. Sloan of Port Huron is manager.

Stanton, Mich.—The city has voted $10,000 bonds for the construction of water works and electric light system.

Baraga, Mich.—The village has voted $30,000 bonds for light and water plants.

Kirkwood, Mo.—The city has voted $10,000 bonds for improving the municipal light plant.

Princeton, Mo.—A $70,000 bond issue for water works and electric lighting extensions has been voted.

Bismarck, N. J.—The city is contemplating installation of street lighting system.

Binghampton, N. Y.—The installation of a boulevard lighting system and underground wiring is contemplated. S. W. Murray, cy. clk.

Freeport, N. Y.—The city is contemplating electric lighting extensions, to cost $10,000.

Lewiston, N. Y.—The Lewiston & Lake Shore Power Co. has been organized to furnish electric light and power to Lewiston, Youngstown, etc.

Columbus, O.—The contract for furnishing ornamental lamp standards will be re-advertised. H. S. Holton, dir. of pub serv.

Wagoner, Okla.—The Benham Engineering Company of Oklahoma City, Okla., has been retained to make the plants for water works and electric light extensions to cost about $40,000.

McMindell, Ore.—The city is contemplating the installation of a cluster lighting system. Three light ornamental poles will be used.

Salem, Ore.—The Portland Railway Light & Power Co. will install ornamental lights.

Altoona, Pa.—A charter has been granted to the Altoona Gas & Fuel Co., capital $5,000.

McKees Rocks, Pa.—The Pennsylvania Light, Heat & Power Company has been granted a franchise by the city.

Moanville, Pa.—The borough is contemplating the installation of an ornamental lighting system. About 90 lamps will be needed.

New Alexandria, Pa.—The New Alexandria Electric Light Co. has been organized for the purpose of supplying lgihts to the town.

Pittsburg, Pa.—The Allegheny County Co. is reported to be spending $700,000 in laying underground conduits, building new power and substations, and extending its lines into new territory.

Dillon, S. C.—The city has voted $3,000 for lighting improvements.

South Pittsburg, Tenn.—A charter has been granted to the South Pittsburg Light Co., capital, $10,000.

Bryan, Tex.—A $20,000 bond issue for water works, sewers and electric light plant has been voted.

Danville, Va.—The Scofield Engineering Co., of Philadelphia, is preparing plans for a municipal light plant.

Ellensburg, Wash.—A $110,000 bond issue for the construction of a municipal light plant has been voted.

Seattle, Wash.—The city council has authorized the installation of ornamental street lamps in Jackson street, etc.

Fairmont, W. Va.—The Outlook Farms Co. of this city have been incorporated to construct sewers, build electric light plants, etc., capital, $15,000. Incorporators: J. M. Hartley, W. J. Wiegel, Glenn F. Barns, N. M. Neeley, and H. S. Lively.

Red Deer, Alta.—Preliminary surveys are being made for the construction of a municipal hydro-electric plant. R. T. Davidson, sec. bd. of trade.

London, Ont.—The citizens have petitioned for the extension of th ornamental street lighting system.

Prince Albert, Ont.—The construction of a municipal power plant at La Colle Falls is planned.

Santos, Brazil, S. A.—The American Consul reports that bids will be received Nov. and drainage; and on Nov. 14 by the city of Pelotas for electric light and power works. 12 at Rio Grande for water works, paving

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Paterson, N. J.—Oct. 17, 4 p. m. Constructing garbage disposal plant as follows: 1. Furnishing material for constructing garbage and refuse incinerating plant. 2. Furnishing plans and right under patents for the city of Paterson to conduct incinerating plant. 3. Constructing driveway and platform. Certified check, 5 per cent. Gilbert McCrystal, pres. bd. of pub. wks.

CONTEMPLATED WORK.

Pasadena, Cal.—The city is contemplating the installation of an electrical incinerator at the municipal sewer farm.

San Diego, Cal.—The city is contemplating the construction of a garbage reduction plant.

Bridgeport, Conn.—The city garbage disposal plant has been destroyed by fire and will have to be equipped with new apparatus.

Trenton, N. J.—The installation of a garbage crematory in South Trenton is contemplated.

Utica, N. Y.—A contract will be let within a few weeks for the collection of garbage. Secretary Day, bd. of con. and sup.

Yonkers, N. Y.—The city is contemplating the construction of a garbage incinerator.

Homestead, Pa.—The borough is contemplating the construction of a garbage disposal plant.

North Braddock, Pa.—A tract of land has been purchased for the purpose of erecting a garbage disposal plant. The garbage disposal committee is authorized to contract for a 20-ton incinerating plant.

San Antonio, Tex.—The city is contemplating the construction of a garbage incinerator, to cost about $25,000.

Morgantown, W. Va.—The city is contemplating the construction of a garbage incinerator.

Superior, Wis.—The city is contemplating the construction of a garbage crematory, to cost $25,000.

FIRE APPARATUS.

CONTEMPLATED WORK.

Emeryville, Cal.—The city is contemplating the purchase of a new combination fire engine and hose cart, auto-propelled.

Valdosta, Ga.—Chief Brooks and the committee on fire and light have been given authority to purchase a 70-horse power auto fire truck, with chemical tank, hose and ladders.

Muncie, Ind.—The city is contemplating the purchase of motor fire apparatus.

Wymore, Ind.—Purchasing Agent Mentgen has been authorized to obtain prices on a chemical engine.

Brockton, Mass.—The city is contemplating the purchase of a combination auto hose wagon and chemical wagon.

East Braintree, Mass.—The city is contemplating the purchase of motor fire apparatus.

Grafton, Mass.—The city is contemplating the purchase of motor fire aparatus.

New Bedford, Mass.—The city is contemplating the purchase of fire apparatus to cost about $2,500. Address Merton W. Swift.

Quincy, Mass.—An appropriation of $49,000 to purchase motor fire aparatus has been asked.

Wakefield, Mass.—The city is contemplating the purchase of motor fire apparatus. Wm. E. Pade, ch. engr.

Minneapolis, Minn.—The national board of fire underwriters have recommended the installation of motor fire apparatus throughout the entire city.

Blue Springs, Neb.—The city is contemplating the purchase of a fire engine.

Wymore, Neb.—The city council has voted to buy a chemical fire engine and make other improvements to the fire fighting equipment.

Binghamton, N. Y.—Commissioner Henwood is preparing specifications for auto fire apparatus. Bids will be requested soon.

Brockport, N. Y.—The city is contemplating the purchase of a chemical engine.

Dunkirk, N. Y.—The city contemplates the construction of a fire station. H. B. Beebe, Fredonia, N. Y. arch.

Elwood City, N. Y.—The city is contemplating the purchase of motor fire apparatus.

Herkimer, N. Y.—The village is contemplating the purchase of motor fire apparatus to cost about $3,500.

Mechanicsville, N. Y.—The village is contemplating the purchase of motor fire apparatus.

Melrose, N. Y.—The village has decided to purchase a chemical fire engine. Ellis M. Lounsberry, pres.

New York, N. Y.—Fire Commissioner Johnson has requested $11,995,542 for the extension and improvement of the fire department. It is planned to replace all horse-drawn equipment with motor fire apparatus.

Durham, N. C.—The city is contemplating the purchase of motor-driven fire apparatus.

Mott, N. D.—A $10,000 bond issue for fire apparatus and water works system is contemplated.

Massillon, O.—The city is contemplating the purchase of an auto fire engine. Jerome F. Shetley, dir. of pub. saf.

Tulsa, Okla.—City contemplates constructing a central fire station, $10,000. E. B. Cline, cy. clk.

Nephi, Utah.—The city is contemplating the purchase of a new chemical engine.

Seattle, Wash.—The city is contemplating the installation of a central fire alarm system, to cost about $45,000 and also for the purchase of 25 police signal boxes for the police alarm system.

Wheeling, W. Va.—The board of control contemplates building a $6,000 engine house.

Milwaukee, Wis.—Acting Chief George M. Linkman has deferred action on the purchase of motor fire apparatus until after the convention of fire chiefs to be held in Milwaukee.

MUNICIPAL ENGINEERING

VOLUME XLI NUMBER FIVE

NOVEMBER, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

LABOR COST DISTRIBUTION, PAY ROLL SYSTEM.

IN beginning the consideration of the construction period reference must be made at once to the "Itemized Cost Estimate" (August number) and a condensed list made of those main divisions of work which should be carried separately on the regular time sheet report.

The time sheet prepared is a form which is the result of many years' experience and which is so arranged that it may be used for any character of work, carried either as weekly or daily reports to the office or to the contractor.

The instructions for the use of time sheet appear on the right hand side of the reverse side of sheet but as in the reproduction of Plate XII the type is very much reduced the instructions are given following:

INSTRUCTIONS FOR USE OF TIME SHEETS.

"It is intended that this sheet shall be used for all jobs, whether timekeeper makes report to pay-roll clerk daily, weekly, or monthly, and is to be used also for making summary reports. In using time sheet side, always place date at head of column and when making out summary sheet, place daily dates in the name column. In using the distribution side, the column marked "Timekeeper's check column" must have dates placed at the head corresponding to the time sheet side, and each column represents one day, the distribution being taken four times per day and marked inside of the four little squares, using distribution letter. However, for daily sheets, each vertical column represents one hour, and separation of time must be checked to the hour. Distribution columns will be headed by rubber stamp for each job and each man's time must be distributed under the proper columns and the totals reduced to dollars and shown at foot of sheet, except that for summary sheets, total for each day will show opposite same. Timekeepers must keep careful record of cars received, expense and cement and fill out form on opposite page. Timekeepers and engineers will co-operate to insure that summary sheets are correct as to time distribution and amount of work done. Daily time sheets must be turned in to the office at the close of each day, weekly time sheets each Thursday evening, and bi-monthly or monthly sheets will be separated and turned in at least once each week. No change of rate of pay will be allowed between pay-roll periods.

"No deviation from these instructions will be allowed on any job."

It will be noted that the distribution columns are headed by letters. No two jobs may have the same letter for the same kind of work, but for the particular job each letter stands for a classification of work and the cost distribution book is likewise headed so that there can be no error.

The actual size of this time sheet is 8¼ inches high by 10 inches wide and provides for 25 names and 13 distributions. In use the time sheet should be placed in a cover as shown in Plate XII, which holds the sheet by the corners in the same manner as the ordinary desk pad. The covers can be placed in the side pocket of the coat, being 5¼ inches by 8½ inches. One corner of the sheet is left out of its pocket in Plate XII.

Plate X shows the front or time-keeping side of the time sheet arranged for daily reports. Plate XI shows the same form of time sheet as used for weekly reports. The top and bottom of these sheets are shown, the number of lines between being sufficient to fill the space between, which can be estimated from Plate XII.

Plate XII shows the reverse side of time sheet and special notice is called to the right hand side where a continuous record is obtained of the job from beginning until completion.

In the beginning of a job under this system the men are all given numbers beginning with the superintendent as No. 1.

Identification cards are issued, as shown by Plate XIII. These cards are retained until the end of the pay roll period, generally one week, and surrendered in exchange for the pay roll envelope containing wages. Each week new cards should be issued of different colors so in rotation that one color will not be used again for at least one month. This scheme obviates the disadvantages of the brass check sys-

TIME SHEET, JOB NO. 20 FROM _____ TO 10/13/11

FOR INSTRUCTIONS SEE REVERSE SIDE

TIME KEEPERS CHECK COLUMN — SEE INSTRUCTIONS — CONTRACT No. 20

NO	NAME (SEE INSTRUCTIONS)	DATES	TOTAL HOURS	RATE	TOTAL AMOUNT $	TOTAL AMOUNT c	DATES OR HOURS (6 AM 7 8 9 10 11 12 1 2 3 4 5 6 7 PM)	DISTRIBUTIONS (SEE INSTRUCTIONS) A Excavation	B Filling	C Concrete	D Forms	E Finish	F Brick	G Stone	H I J K L M Specials
	BROUGHT FORWARD														
8	James Brown		10	25	2	50	A A C	5		5					
9	Pete Mike		6	20	1	20	C C C C			6					
	TOTALS				3	70	TOTAL HOURS	5		11					
							TOTAL NEAREST DOLLAR	1		2					
	SIGNED Henry Jones.						TOTAL CEMENT USED (BAGS)								

X. CONTRACTING PRACTICE. Time Sheet. Daily Report Form.

TIME SHEET, JOB NO. 21 FROM 10/7 TO 10/13/11

FOR INSTRUCTIONS SEE REVERSE SIDE

TIME KEEPERS CHECK COLUMN — SEE INSTRUCTIONS — Contract No. 21

NO.	NAME (SEE INSTRUCTIONS)	DATES 10/8 Sun.	10/9 Mon.	10/10 Tue.	10/11 Wed.	10/12 Thu.	10/13 Fri.	10/7 Sat.	TOTAL HOURS	RATE	TOTAL AMOUNT $	TOTAL AMOUNT c	DATES OR HOURS Sun. Mon. Tue. Wed. Thu. Fri. Sat.	DISTRIBUTIONS (SEE INSTRUCTIONS) A Excavation	B Filling	C Concrete	D Forms	E R.-Concrete	F Forms & C.	G R.-Steel	H Cem. Finish	I Brick	J K L M Extras
	BROUGHT FORWARD																						
72	Richard Roe		10	10	3				23	.20	4	60	A A A C	5	10	8							
73	John Doe		10	10	10	10	10	10	60	.20	12	00	A A A C C C C C C C C C	10	5	45							
	TOTALS												TOTAL HOURS	15	15	53							
													TOTAL NEAREST DOLLAR	3	3	11							
	SIGNED John Smith												TOTAL CEMENT USED (BAGS)			450							

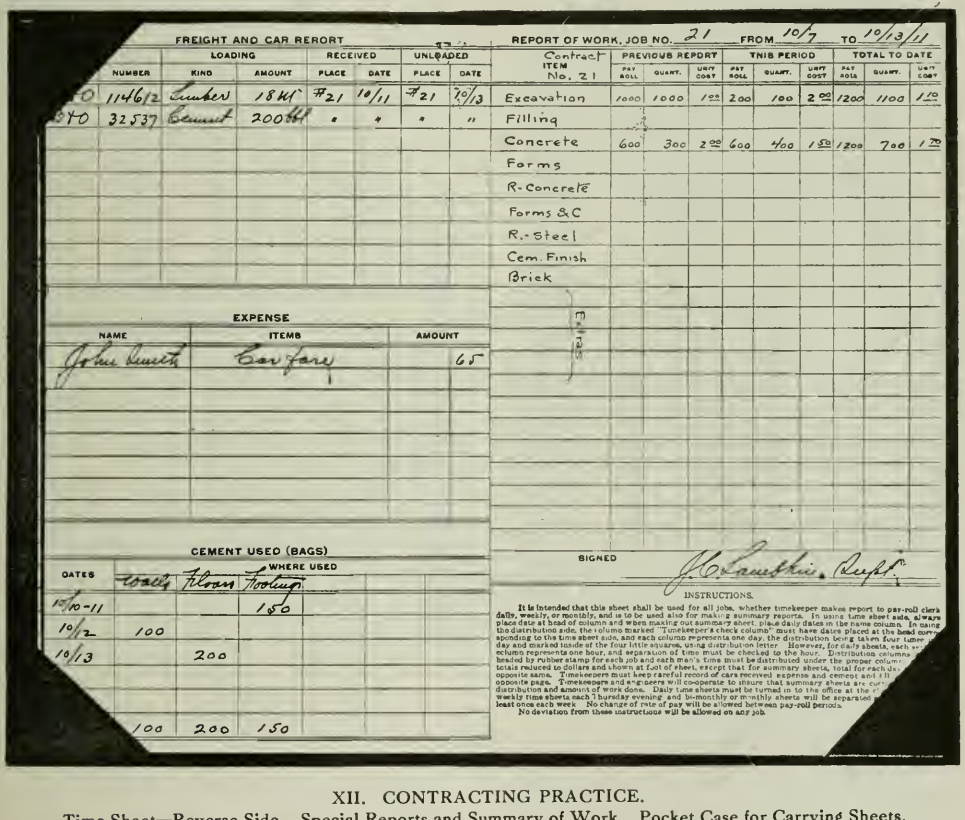
XI. CONTRACTING PRACTICE. Time Sheet. Weekly Report Form.

tem while fulfilling the same purpose. The cards can be expected to remain in good condition for a reasonable period, they serve the purpose of absolute identification, and are receipts beyond question when in the hands of the paymaster.

By using the different colors, there can be no duplication or errors due to the numbers assigned to the men. For instance, No. 72 on the week yellow cards are used may not be the same as No. 72 the next week when blue cards are issued.

prepares his pay roll, Plate XIV. A pay roll should be prepared day by day, as one hour's work per day will mean seven hours or a whole day at the end of the week and such a procrastination may result in a failure to complete the pay roll on time or at least to increase the chance for many careless, otherwise unnecessary, errors.

The pay roll envelopes are then prepared, using the pay roll as a basis and these envelopes of form Plate XV are



XII. CONTRACTING PRACTICE.
Time Sheet—Reverse Side. Special Reports and Summary of Work. Pocket Case for Carrying Sheets.

This arrangement allows that the older men in life of employment may be moved up from time to time so that the higher numbers are indicative of new untried men, thereby bunching the steady employees in the tabulation on the pay roll. The colors to be used are red, blue, yellow and green. The men generally wear the cards in their hat bands. The simplification of work to the timekeeper and paymaster is beyond computation.

The time sheets are filled out from day to day and handed to the paymaster, who

made in colors the same as the identification cards, so that a man who calls for his money several days or weeks after pay day can not be confused with any other man of possibly the same number or name working during a different pay roll period.

During the interval of pay roll periods it is necessary to discharge many men, which is brought into harmony with the general system by the use of Discharge Blanks, Plate XVI.

Let us trace regular and floating employees through their introduction to this

system using both daily and weekly reports.

We will suppose we have two jobs under construction, one on a basis of daily reports and one weekly. In both cases all men employed have been assigned numbers and cards as per Plate XIII.

The hours, rate and amount are not filled out on card unless for a particular reason it is desired to obtain a definite receipt.

The time sheets, Plates X and XI, show these men and time made by them and the character of work upon which they were placed.

Note by Plate X that James Brown, No. 8, worked 10 hours from 7 a. m. until 12 m., and from 12:30 until 5:30 p. m., making 10 hours, of which 5 was on excavation and 5 on concrete.

Pete Mike, No. 9, came on at 11 a. m., and worked one hour until 12 m. on concrete, then began at 12:30 p. m., worked until 5:30, making 6 hours. The time spacing at head of timekeeper's column being arranged for each division for one hour, the top half is for the hour and the bottom half for the half hour. It is not necessary to mark distribution letter in each column as it is understood the man continues on the same work until by a distribution letter change he is placed on other work at the closest hour or half hour.

Assuming at the same time we have job No. 21 running on a basis of weekly reports, we see Richard Roe, No. 72 (Identification Card, Plate XIII), worked Monday to Wednesday, being discharged on the latter day, having made 23

[redacted] COMPANY

IDENTIFICATION TICKET

Countersigned John Smith Timekeeper

Name Richard Roe

Contract No. 21 Roll No. 72

Pay Roll Ending Oct. 13th 1911

Hours ____ Rate ____ Amount ____

Rec'd Payment Richard Roe

XIII. CONTRACTING PRACTICE. Identification Card.

[redacted] Co.

(Sawbkin) GANG NO. (1) AT #21.

FROM 10/7 TO 10/13

PAY ROLL

CONTRACT NO. (21) A B C & Co. (Contracting Party) AT Metropolis (Location)

No.	NAMES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Hours	Rate	Total Amt. Pay Roll	DEDUCTIONS: Co. Board	Co. Supplies: Item	Co. Supplies: Amount	Cash Advances: In favor of	Cash Advances: Amount	Miscellaneous: In favor of	Miscellaneous: Item	Miscellaneous: Amount	Net Amount Due	How, When and to Whom Paid	No.
1																																															1
72	Richard Roe										10	10	3																				23	.20	4 60					Co.	4 60					Discharged #3701 10/13/11	2
73	John Doe							10			10	10	10	10	10																		60	.20	12 00	3 00				D.Y.M.	3 00					6 00		3
4																																														4
5																																														5
30																																														30
31																																														31
	TOTALS							10			20	20	13	10	10																		83		16 60	3 00					7 60					6 00		

Correct John Smith Pay Roll Clerk.

Correct J.C. Sawbkin Supt. Const.

Approved A.B. Jones Treasurer.

Paid Oct 14th 1911 A.B.J. Paymaster.

XIV. CONTRACTING PRACTICE. Pay Roll.

Roll No. 2

John Doe
NAME

10/14/11
DATE

Contract No. 21 $ 12.00

ADDITIONS

Contract No.			
" "			
" "			
Deductions $			
Board	3	00	
Cash D.V.M.	3	00	
Net Amt. this Envelope			6 00

[redacted] Company
[redacted] BUILDING
[redacted]

XV. CONTRACTING PRACTICE.
Pay Roll Envelope.

hours. His time for Monday and Tuesday having been turned into the paymaster (possibly the contractor himself), the timekeeper made out his discharge check No. 320, Plate XVI, for the three hours on Wednesday, and the paymaster added the amount for Monday and Tuesday and paid him $4.60 upon surrender of his card, properly signed. Upon the payroll, Plate XIV, the paymaster then writes in the extreme right-hand column "Paid by discharge No. 320." John Doe, on the other hand, having completed a full week's work, is paid upon surrender of his card by a payroll envelope of same name, number and color, as shown by Plate XV, less the proper deductions.

Ordinarily it is assumed that large and important work requires daily reports, while small work, or where there is little changing around of men, can be reported weekly. In the first case by this system changing of distribution may be had to the closest half hour. In the latter case a separation four times a day would seem sufficient.

This system is flexible and can be applied to any organization, large or small. The cost of installation is small and the results attained more than justify the expense.

The payroll provides for deductions for various accounts, and the payroll envelope provides for a corresponding statement of the account of the workman, stating the gross amount of money earned, even if employed on various jobs, and giving deductions.

[redacted] COMPANY
[redacted] BUILDING

No. 3201 Contract No. 21 Date Oct. 11/1911
Roll No. 1

TO THE PAYMASTER: This Certifies that Richard Roe is entitled to pay for 3 hours labor @ 20 cents per hour as shown by the time sheets for pay-roll period ending 10/13 time ending 10/11

Amount 4.60 ¢
Additions 4.00
Total 4.60
Deductions —
Net 4.60

Correct: John Smith
Timekeeper

Approved: J. C. Lamberti
Foreman

XVI. CONTRACTING PRACTICE. Discharge Certificate.

Discharge No. 3201
Date 10/11/11
Name Richard Roe
Roll Ending 10/13
Time Ending 10/11
Hours 3 Rate 20 ¢
Amount 60 ¢
Contract No. 21
Roll No. 1

Standard Tests for Asphaltic Cements for Sheet Asphalt Pavements.*

By James W. Howard, Consulting Engineer, New York City.

FOR many years there has been great need of a definite set of standard chemical and physical tests to enable a properly educated and experienced person, equipped with suitable laboratory apparatus, to determine whether or not an asphalt-cement is good for use in constructing a sheet asphalt pavement and its underlying binder.

It is not necessary to state all the reasons why such a series or standard set of tests has not been determined and made public. It is sufficient to say that, in the early days of sheet asphalt pavements of the asphalt-cement, sand, stone-dust mixture type, there were no definite known tests, and that as separate tests were slowly devised, exact knowledge of what tests and standards to use was withheld from city officials and the public. This was done for commercial motives of control by those desiring to sell their brands of asphaltum or contracting to lay such pavements, also by the few semi-independent engineers and chemists, who have for a long time tested and determined the qualities and usefulness of asphalt cements.

An experience of more than twenty years constructing and inspecting pavements; selecting, preparing and using asphalt-cements in pavements, writing specifications, operating a road and pavement testing laboratory, determining the relative, scientific and practical qualities of paving materials of many kinds and deciding whether or not such materials met requirements or quality specified or needed for successful use, has compelled the writer to obtain and devise a standard set of chemical and physical laboratory tests, not only to be able to repeat old, successful pavements on new streets, but also to predetermine if new asphalt-cements made from materials from new sources of supply could be successfully used.

Asphalt-cement is one of the three direct component parts of the sheet asphalt layer (the other parts being sand and filler). It is one of the component parts of the binder (the other part being crushed stone or its equivalent). A city or independent contractor should not be concerned in the materials from which an asphalt-cement is manufactured nor how it is manufactured. Specifications should not mention or describe crude or refined asphalts, residuum oils or fluxes by name, description, tests or otherwise. No specifications or users of Portland cement dictate the source of supply, kind of limestone, or test ingredients from which Portland cement is made. Cities and contractors, except those interested in crude supplies, are not or should not be concerned with the ingredients of any asphalt or other cement. They should specify the qualities of the asphalt-cement ready for use; just as specifications for concrete foundations of pavements state what standard tests Portland cement must meet to be acceptable.

Many city specifications, including those suggested by certain associations, describe the various crude asphalts or refined asphalts, fluxes, etc., and how they shall be put together; but do not set forth a set of standard tests or criteria of excellence which the resulting asphalt-cements must meet to be good and acceptable.

Specifications emanated originally from various commercial sources and as the art developed and became general, the relics of those commercial influences are still apparent in all asphalt pavement specifications. This is shown either by the brand names of asphalts, as in Wichita, Kans., or by alleged tests, as in Philadelphia, and in Manhattan, borough of New York City, which tests do not determine quality but covertly describe controlled, limited crude or refined asphalts. All such specifications are made to "let in" or "exclude" one asphalt or another. All specifications should be so drawn as to include all materials which produce good results. This is best done in the case of asphalt-cements, as well as Portland cements, by having the specifications enumerate a set of tests which each must meet.

Many city engineers and independent contractors, above all suspicion of political or wrong motives, have unconsciously copied the objectionable specifications referred to; thus getting less competition and poorer pavements. It is evident that the tendency of associations or societies, containing commercial producers, has been to include in specifications materials produced by the commercial members and to fail to include materials not represented before committees or in open conventions.

The requirements of many past and existing specifications regarding crude asphalts, refined asphalts, fluxes and their various general combinations to make asphalt-cement, permit but do not insure

* A paper before the American Society of Municipal Improvements.

the production of definite, good asphalt-cements. None of such specifications contain sufficient tests and standards which asphalt-cements must meet, to either predetermine the qualities of such cements offered for use, or when extracted from existing sheet asphalt pavements, to determine whether or not they are good.

Specifications should omit all reference to crude and reefined asphalts, to fluxes and other component parts of asphalt-cements and set forth what definite qualities asphalt-cements must possess to be acceptable for use. A few experienced engineers and chemists, for many years, have tested asphalt-cements, manufactured and used them with success and know what qualities such cements must possess.

The writer, for several years, has prepared and used his standard chemical and physical tests for asphalt-cements for use in sheet asphalt pavements and in binder. He takes pleasure in now submitting this list in the interest of good pavements; hoping it will be another step toward placing sheet asphalt pavements on a definite, scientific, engineering basis.

It is well known that asphalt-cement is not the only ingredient of asphalt pavement of the type in general use in America. It is the ingredient, however, for which, up to the present time, no definite set of standard tests with degrees of excellence they must meet, is published. The qualifications and tests for sand, limestone, dust or other filler, proportions of mixtures and methods of constructing this pavement are known or easily obtainable.

The accompanying tabulation of what may be termed the "Howard standard tests of asphalt-cements for sheet asphalt pavement," is compiled from his laboratory records of tests of several thousand samples of asphalt-cements used in this type of pavement during the past twenty-four years. They represent the characteristics of all asphalt-cements made from all the many available refined asphalts and fluxes from American and foreign sources of supply and competing with each other. The fifteen samples (with one exception) enumerated as A. B. C., etc., represent all asphalt-cements which have met all required standards of good asphalt-cements during the past twenty-four years. The exception is sample IV, put in the table because it is successful in every respect except that it is seriously affected by water, as shown by tests Nos. 20, 21, 22 and 23, and makes a shorter lived pavement.

The last column of the table, headed "*Standard Tests Recommended,*" shows the standards, criteria or degreees of excellence which, when all 27 tests are met, assure a city or contractor that he is using a good asphalt-cement in his binder layer or in his sheet asphalt pavement surface layer.

NOTES ON THE TABLE.

It is not necessary here to describe the methods of making the tests, because it is presumed that they will be made by properly educated and experienced engineers or chemists familiar with such testing or who can obtain the methods of making many of these tests from the publications of the Am. Soc. of Municipal Improvements, or the Am. Soc. for Testing Materials, U. S. Government and other publications. This society and others have heretofore confined themselves to careful descriptions of methods of testing, but have not determined what standards or criteria each test should meet nor have they determined a complete series or set of tests, which, if met, will fully establish the quality of asphalt-cement.

Test No. 1. The purity in bitumen indicates the presumable absence of deleterious matter; also whether one asphalt-cement, because purer, will produce more pavement than another.

Tests Nos. 2 and 3 indicate impurities which cost useless initial purchase price and freight or may or may not be injurious to the pavement because affected by water or otherwise.

Tests Nos. 4 and 5, while using the words "petrolene and asphaltine" (not definite substances) indicate the proper per cent. of solubility and non-solubility in standard naphtha of the bitumen in an asphalt-cement.

Test No. 6 is a method of obtaining the practical equivalent, with needed increased per cent., of test No. 4, in and near California, where it is difficult to obtain the standard naphtha of test No. 4, but where the uniform sulphuric-ether named can be obtained, which ether is obtainable everywhere, and because uniform should eventually replace naphtha test No. 4.

Test No. 7 simply suggests whether or not the asphalt-cement is pure bitumen and is of a kind in successful use in the past.

Test No. 8 gives the melting point with such accuracy that different persons can automatically get the same results and eliminates the personal equation.

Test No. 9 indicates the presence or absence of easily volatile matter and avoids unnecessary expensive apparatus.

Test No. 10 is the chewing test in practical use for many years. If an asphalt-cement cannot be chewed, but becomes like lard or slime, it is not good.

Test No. 11 is the usual well-known ductility test.

Tests Nos. 12, 13 and 14 are made with penetrating apparatus made by several competing makers; but the weight and time of penetration in each case is made

HOWARD STANDARD TESTS FOR ASPHALT-CEMENTS FOR SHEET ASPHALT PAVEMENTS.

(Samples A, B, C, etc., are asphalt-cements used from 10 to 30 years in many cities.)

Test No.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	—From Preceding— Max'm.	Min'm.	Standard Test required.
1. Solubility in carbon bisulphide, purity in bitumen, per cent	99.70	99.70	99.70	99.70	99.70	99.70	99.70	99.70	99.80	99.60	82.20	82.60	82.80	67.00	95.10	99.80	67.00	100 to 65
2. Organic matter, not bitumen, impurity, per cent	.20	.20	.20	.10	.10	.10	10	.10	10	.20	3.80	3.10	2.20	5.90	1.60	5.00	.10	0 to 35
3. Mineral matter, not bitumen, impurity, per cent	.10	.10	.10	.20	.20	.20	.20	.20	.10	.20	14.00	14.30	15.00	28.00	3.30	28.00	.10	0 to 35
4. Petrolene, or solubility of pure bitumen in 75 B. etc., naphtha (Howard Standard), per cent	74.10	77.00	76.30	78.00	73.90	76.00	74.80	75.20	77.00	78.10	70.80	70.70	70.50	80.00	80.70	80.70	70.50	80 to 70
5. Asphaltene, balance of pure bitumen, per cent	25.90	23.00	23.70	22.00	26.10	24.00	25.20	24.80	23.00	21.90	29.20	29.30	29.50	20.00	19.30	29.50	19.30	30 to 20
6. Solubility of bitumen in sulphuric-ether U. S. P. 1900 (Calif. method), per cent	84.20	85.60	85.20	86.00	78.20	78.40	78.20	80.00	82.20	84.20	78.60	79.70	78.90	87.50	83.60	86.00	78.20	86 to 78
7. Spec. gravity	1.013	1.015	1.013	1.011	1.032	1.022	1.029	1.021	1.058	.9937	1.123	1.134	1.138	1.271	1.043	1.274	.9937	.993 to 1.25
8. Melting point (Howard mercury method), F.	110.00	142.00	116.00	144.00	158.00	160.00	160.00	174.00	150.00	150.00	162.00	160.00	160.00	174.00	150.00	174.00	140.00	140 to 174
9. Flash open crucible, F.	486.00	480.00	600.00	490.00	440.00	440.00	440.00	440.00	490.00	526.00	460.00	420.00	440.66	470.00	460.00	600.00	420.00	400 to 600
10. Chewing test during 15 minutes	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good	good
11. Ductility at 77 F. 1 sq. cent. cross-section; broke at length, centimeters	100.00	100.00	100.00	99.00	90.00	28.00	27.00	21.00	41.00	24.00	11.00	13.00	22.00	25.00	30.00	100.00	13.00	10 to 100
12. Penetration, consistency or softness at 32 F. No. 2 needle, 100 grs., 5 secs. (Howard uniform method), centimeters	.03	.03	.02	.05	.07	.10	.09	.08	.07	.11	.09	10	.09	.05	.04	.11	.02	.11 to .02
13. Penetration, consistency or softness at 77 F. No. 2 needle, 100 grs., 5 secs. (Howard uniform method), centimeters	.57	.56	.57	.63	.57	.62	.63	.62	.60	.70	.65	.65	.67	.60	.67	.70	.56	.50 to .75
14. Penetration, consistency or softness at 100 F. No. 2 needle, 100 grs., 5 secs. (Howard uniform method), centimeters	1.90	1.92	2.11	1.98	2.50	1.50	1.58	1.55	1.35	2.72	1.75	1.80	1.90	1.90	2.05	2.72	1.35	1.35 to 2.70
15. Pliability on breaking glass at 32 F (Howard method)	slight	slight	slight	fair	fair	fair	fair	fair	fair	good	good	good	good	slight	slight	good	slight	slight
16. Evaporation, 50 g. at 212 F., 1 hr loss of weight, per cent	0.00	0.00	0.00	.01	.01	01	.01	.01	01	0.00	trace	trace	trace	.80	.11	.80	0.00	0 to 8
17. Evaporation, 50 g. at 325 F., 5 hrs loss of weight, per cent	.42	.64	.33	.26	1.20	1.19	1.44	.63	.48	29	.35	.44	1.10	1.38	2.04	2.04	.26	.2 to 2.5
18. Penetration of residue after test 17 No. 2 needle, 5 secs., at 77 F., centimeters	.38	.40	.41	.42	.29	.35	.34	.42	40	64	.41	.45	.52	.30	.45	.64	.29	*
19. Hardening of residue of No. 17 compared with pen. of A. C. test No. 13, per cent	33.00	29.00	23.00	33.00	49.00	44.00	46.00	32.00	33.00	9.00	32.30	31.00	22.00	50.00	33.00	50.00	9.00	50 to 0
20. Water effect on A. C. coated on glass, immersed one week, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	soft	greyish	soft	0.00	greyish—0
21. Water effect on A. C. coated on glass, immersed 30 days, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	decay	grey	decay	0.00	greyish—0
22. Water effect on cylinder of sand and A. C., immersed one week, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	soft	greyish	soft	0.00	greyish—0
23. Water effect on cylinder of sand and A. C., immersed 30 days, waterproof or water weakness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	decay	grey	decay	0.00	greyish—0
24. Adhesion at 32 F. 1 sq. in. in sec Howard St'd briquette sand and A. C. broke, lbs. tension	363.00	352.00	347.00	327.00	312.00	261.00	182.00	180.00	293.00	157.00	253.00	206.00	206.00	348.00	267.00	363.00	157.00	Above 150
25. Adhesion at 77 F. 1 sq. in. in sec Howard St'd briquette sand and A. C. broke; lbs. tension	94.00	80.00	75.00	60.00	53.00	63.00	47.00	10.00	41.00	25.00	38.00	54.00	37.00	76.00	29.00	94.00	25.00	Above 25
26. Compression at 32 F. Howard St'd cylinder sand and A. C. crushed at lbs. per sq. in	1290.00	1202.00	1153.00	975.00	750.00	831.00	631.00	565.00	787.00	422.00	662.00	664.00	648.00	1180.00	703.00	1202.00	422.00	Above 400
27. Compression at 77 F. Howard St'd cylinder sand and A. C. crushed at lbs. per sq. in	170.00	222.00	169.00	181.00	225.00	157.00	257.00	127.00	229.00	116.00	169.00	154.00	155.60	222.00	159.00	257.00	116.00	Above 110

*Variable to get No. 19.

to conform and not irregular as often heretofore used. Therefore uniform penetration curves or increasing softness under increasing heat can be platted. All variables are eliminated except the one of softness or consistency of the cement being examined.

Test No. 15 is made on glass and determines if the cement is brittle or not when the glass is broken.

Tests Nos. 16, 17, 18 and 19 are well known and indicate the stability or durability of an asphalt-cement when exposed for years to hot weather.

Tests Nos. 20, 21, 22 and 23 determine whether or not an asphalt-cement, in thin films between the particles of the mineral aggregate of a pavement, will be injured and decayed by the action of rain and other water on, in or under a pavement.

Tests Nos. 24 and 25 are made upon briquettes composed of special standard clean sand and practically pure bitumen of the asphalt-cement, compressed to constant density in an apparatus and machine permitting several thousand pounds pressure per square inch. Adhesion is one of the most essential qualities of asphalt-cement and not to be opposed from any engineering standpoint. The use of this test is of great help toward securing good pavements.

Tests Nos. 26 and 27 are made on larger and different shaped briquettes of the same composition and compressed in the same way as tests Nos. 24 and 25; but tests Nos. 26 and 27 while indicating adhesion, determine cohesion, which in sheet asphalt pavements depends almost entirely upon the asphalt-cements used in the pavement mixture.

Conclusion: To fully determine whether or not an asphalt-cement is good for use in sheet asphalt pavement, it is necessary to make the entire set or series of twenty-seven standard tests shown in the tabulation and have them meet the requirements indicated in the last column. The climate, kind and quantity of traffic, the location of the pavement to be constructed in respect to exposure to sun and other environments, must be considered, and the consistency, softness or penetration adjusted accordingly, but (with very few extreme special exceptions) within the limits indicated by tests Nos. 12, 13 and 14; the other tests remaining within the limits set forth in the last column of the tabulation.

This group or set of tests and criteria will not determine the qualities of asphalt or bituminous cements for bituminous stone poured and mixture pavements; for which special cements the author hopes to some day submit a standard set of special tests.

Bituminous Concrete Pavements.*

By H. G. Lykken, C. E., Grand Forks, N. D.

TO begin with I wish to define a Bituminous Concrete Pavement as a pavement composed of a compressed composition of crushed rock, sand and mineral dust aggregate with a binder of either coal tar pitch or asphalt cement, mechanically mixed before being spread on the roadway. While not considering the ordinary form of sheet asphalt pavement strictly a bituminous concrete, it may be considered under the same heading; for, after all, it is but an asphalt binder and a mineral aggregate somewhat finer than that in the regular concrete, yet otherwise the same. We may in one sense call a mixture of hydraulic cement and sand a concrete, as well as the mixture in which the aggregate is purposely coarser. In fact, our modern conception of a true concrete with its minimum voids in the aggregate, and all that, began with the sand and cement mortar of ancient origin to which more or less crushed stone and gravel aggregate was added.

I cannot help think of the analogy between a hydraulic cement and a bituminous cement concrete, and the development of both from the cement and sand mortar; only in the former no one thought of securing a patent on the gradation of the mineral aggregate. The evolution of the coarser mixture from the finer was analogous and inevitable in either case.

Little time can be given here to anything else but the surfacing material, but I wish to state in passing that, in my opinion, all composition pavements should have a Portland cement concrete or vitrified brick gutter of generous width. On slow grades, especially, it is a difficult matter to get a true gradient with a material that has to be compressed in place. If the gutters are built with Portland cement concrete or brick, laid true to line and grade, as they easily can be, a much better job can be had of the composition surface. But the chief advantage is the added life of the pavement. The best bituminous composition will deteriorate from action of the street fluids that accumulate along the gutter line,

*From a paper before the American Society of Municipal Improvements.

where the pavement is generally left porous from insufficient compression as the rollers cannot work close to the curb. Generally this becomes the weak point in the pavement which, with the other construction, forms a sanitary and easily cleaned surface.

The gutter should, however, be a part of the pavement area, and not a part of the curb built separate and distinct from the roadway proper. This is especially necessary where frost may cause a relative displacement of the curb and gutter, as I have seen in so many places.

It will be generally conceded, I take for granted, that a Portland cement concrete foundation is preferable to macadam, bituminous macadam or any other kind of base for a bituminous concrete pavement. Such a pavement must, above all things, have a uniform and rigid foundation. It must be uniform and laid to the correct contour of the finished street surface, as no raker can so gauge the thickness of his material that a dip will not form over every low spot in the base, as the thicker layers of the hot mixture compress more under the roller.

In the greater ease with which a uniform surface can be formed with concrete offsets, in the saving in the material of the bituminous surface and the labor of getting a smooth roadway, lies a considerable part of the possible difference of cost. Besides, lower prices of cement and the development of labor-saving mixing machinery makes a concrete base cheaper in most cases; in more cases, at least, than many users of macadam or bituminous macadam foundation realize.

In laying the concrete base for a bituminous pavement, I have always made it a practice to have the concrete fairly wet, so that it would compact with its own weight, or with slight tamping with the shovel. The finished surface of the base is left rough by drawing the edge of the shovel over it so as to bring the coarse aggregate to the surface. With properly graded gravel it is possible to produce a surface on which I would not hesitate to place even a sheet of asphalt pavement without the use of the binder course.

The object of the roughened surface is, of course, the same as the object of the binder course in sheet asphalt construction—to prevent any tendency of creeping.

Coming back to the surfacing material, I wish first to consider the mineral aggregate. As already stated, I consider it a natural evolution of composition pavements, such as sheet asphalt, to have substituted for the finer and inherently unstable aggregate one which is coarser, graded as to size and inherently stable. I mean here by stability, resistance to pressure and displacement by flow or creeping.

In a sand asphalt composition there is no resistance to pressure and flow as far as the aggregate or sand is concerned. The particles are all free to move but for the resistance offered by the cementing material, and the adhesiveness with which it connects the mineral particles must necessarily be the net resistance it can offer to the displacement of same.

In a graded aggregate where the size of the particles are to some extent commensurable with the thickness of the layer, an entirely different condition obtains. The aggregate itself will resist both pressure and lateral displacing forces. The cement serves to equalize the strains and adds to the resistance, but is relieved from possibility of excessive distortions and resulting weakening.

It seemed natural to add crushed rock to hydraulic cement mortar, and equally natural to develop an inherently stable aggregate as the modern conception of a good hydraulic concrete. It should seem equally natural to treat a bituminous mixture in the same manner. And as far as can be learned, the first attempt at making a bituminous concrete was by adding to the bituminous sand mortar or standard sheet asphalt mix the crushed rock with little consideration paid to its grading and sizing. The inherently stable aggregate came as a matter of course.

The doctrine of a stable aggregate, if it can be termed that, is finding a constantly wider acceptance, but there exists a greater diversity of opinion as to the proper size of the mineral particles. The earlier tendency was towards a coarser mix, up to two inches for the maximum size, as though the pendulum had swung from one extreme to the opposite in departing from the sand aggregate. Later much fine material has been used and considerable paving laid with a mixture grading from two mesh, and even less, as the maximum size.

Assuming that two inches is the proper and economical thickness for an asphalt concrete pavement subject to ordinary traffic, which is perhaps as nearly what it should be as has been determined to date, (for it must be thick enough to have a body of its own, aside and apart from the base, capable of resisting contraction strains, shocks and distortions, have depth so that the oxidation and gradual loss in elasticity, naturally going on in the surface layer will not appreciably reduce the total cohesion of the mass, and for proper manipulating in laying and rolling, yet not be too deep so as to waste material), we are left to determine the proper maximum size for such a thickness.

And here I consider results in the mechanical operation of raking or spreading the hot material on the street to take

precedence over theoretical considerations. There is a pronounced tendency for the coarser particles to segregate in raking and drawing the layer down to the proper thickness. This is not so noticeable and is even entirely absent in a finer mix. I have gotten the best results with an aggregate grading from one and one-half mesh lown. It may be that a slightly coarser aggregate, even one with the maximum size equivalent to half the depth of the finished layer could be used to advantage if properly put down, but under ordinary working conditions a mixture must be supplied which will insure a homogeneous pavement. The finer mix is more easily manipulated under the roller as well, making a smoother street and having less tendency to pit or show an open surface. The tendency to ravel and the larger stones in the aggregate to crush or loosen is also eliminated.

As this size of approximately one-third the depth of the pavement layer for the largest particles in the aggregate seems to be the largest size that will give the best results in the mechanical operation of laying it, I fail to see why larger stones should be used, and I do not think a coarser aggregate would make a more inherently stable mixture.

In grading the mineral aggregate, the same working conditions will limit the theoretical ideal mixture to what the commercial sizes of rock will afford. There is a limit to the number of screens that can be practically used on a mixing plant. While the maximum density of the finished product may always be in the engineer's mind, what he really gets in the long run under the best of conditions is a fairly well graded aggregate of rock particles with the voids filled with a mortar of sand, mineral dust and bituminous cement. That is really what all concretes are commercially, after all, and all that can be expected.

The rock should be hard, but more particularly tough in character, and should have a cubical fracture. If it comes from the crusher such that it ranges in size from one and one-half mesh, or the largest size specified, down to ten mesh, or with all passing a ten mesh eliminated, and in such manner that its mass density cannot be appreciably increased by addition of a quantity of intermediate screen, it can well be considered acceptable. The material screened out in passing the ten mesh screen and grading to impalpable dust, together with clean moderately sharp graded sand, whatever additional dust filler is necesary, and the bituminous cement will constitute the mortar. No hard and fast rule can be established for the proportions of the various ingredients in this mortar. The nature of the bituminous cement used, the sand, climate and traffic conditions, are all factors that must be considered. The finer rock screenings and sand dust must, of course, be used in quantities sufficient to give a certain volume and body to the mix, and the finer dust added in such proportions as to give the proper consistency or stiffness.

The finished pavement will have from 35 to 45 per cent. by weight of this mortar, or a slight excess over that necessary to fill the voids. The pavement will be in effect a graded rock aggregate, not too coarse, but inherently stable and of hard, tough material, having all voids filled with the bituminous mortar; and having sufficient mortar in excess to close fairly well under the roller.

It is a bituminous concrete pavement in every sense that a hydraulic or bituminous cement concrete can be that commercially; but not, as may be well admitted, in the sense of being a mixture graded from the largest particle to impalpable dust in such a manner as to have a minimum of voids, which voids are to be filled with the bituminous cement alone.

There is a greater difference between these two propositions than is first apparent. A mineral aggregate can be well graded and inherently stable, at least for all practical purposes, and be far from having the least possible voids. In such an aggregate it is evident that all voids and interstices will be filled with the mass and volume of the mortar. The rock particles will have a bedding of mortar acting in the three-fold capacity of a cushion, a binder and a matrix, while an aggregate graded so as to possess minimum voids has smaller mineral particles filling the voids between the larger ad infinitum, with but a film coating of the cement between the adjacent surfaces. Such a pavement with an absolute gradation would be hard and nonelastic as the rock of which it is composed.

In the matter of binder or cementing material there is possible a greater diversity of opinion and difference in the character of the product offered the trade. Not only have we far from a standardized bituminous cement, but lack anything that might be called standard specifications for such a material.

It goes without saying that a paving cement must be, first of all, stable and unaffected as far as possible by oxidation and the action of fluids met with in the street. It must not be subject to disintegration by the temperature to which the rock may be heated in mixing, nor by the interaction or breaking up of its own component chemical combinations.

Within the range of temperature to which the pavement may be subjected,

the cement must have a certain fixed cementing quality or adhesiveness, a certain quality of elongation in accommodating itself to contraction of the mineral aggregate due to temperature changes, or ductility, and a certain quality of plasticity usually referred to as penetration.

But a certain factor of adhesiveness at a given temperature is not sufficient, as this quality varies greatly with the changes in temperature. Tests must be taken along the entire range to which the pavement will be subjected, and somewhat beyond both extremes. Such a series of tests could be represented by a curve, termed a curve of adhesiveness. Obviously the cement having a fair and fairly constant factor of adhesiveness would serve all purposes best in this one particular. The cement which at the highest and lowest temperature to which a pavement may be subjected loses that quality is evident deficient.

There are on the market bituminous cements that at certain temperatures excel in this particular but which with a variation from this temperature diverge most extraordinarily. Many of them, while they may be used in the limited climatic range of some localities, become worthless under conditions where the range in temperature is wider.

But as this quality of adhesiveness is intimately related to the sand-carrying quality of the cement, the force required to part two surfaces cemented together with any given sample does not become a true index to its value for paving. In the pavement as laid in the street it is rather the adhesiveness with which the sand and cement mortar holds the coarser aggregate in place, and with which the mortar itself holds together, that deter-

A comparison of the slag with various range of temperature as far as adhesiveness is concerned when tested neat for that quality alone, but when mixed in the mortar, with the same amount and quality of sand and dust filler to produce mines its value. Two given cements may correspond very closely within a given the necessary stiffness or body, the one may be all that can be desired, while the other will be so "short" as to have little or no cementing value.

Thus the cementing quality of the mortar becomes the true criterion; not only that, but the cementing quality of the mortar prepared with the sand and dust materials available on the job for which it is to be used.

In the same manner a curve of ductility covering the same range in temperature would reveal the possible behavior of the pavement under all conditions. A certain ductility at 77 degrees F. means nothing when one cement passing that test may be sufficiently ductile at zero and a range below, while another making an equally good showing will become more brittle than glass.

The ideal cement will have a fair factor of ductility (much is not necessary), but more important, a fairly constant one for all temperatures to which the pavement will be subjected. There are cements on the market having ductility to spare at the right temperature, which crack with the first chill.

A curve of penetration covering the same range of temperature would indicate the nature of the cement, not at certain ideal temperatures alone for that particular material, but at the most trying temperatures to the pavement, when it is too hot or too cold. The ideal cement would have a uniform factor of penetration for the entire range of temperature and not, as some cements on the market, a range from zero to infinity under actual working conditions.

In this connection I wish to submit that a simpler and better method of making the penetration test is to observe the length of time taken by a needle of a given size and given weight to penetrate, say, one centimeter, or any other convenient depth, into the material tested. The apparatus can be much simplified and will consist of a needle fixed to move in vertical guides and weighted with a weight constant for all tests. On the guides will be arranged a centimeter scale reading with a vernier. As the needle is released and after it has begun to penetrate the material, i. e., after it has penetrated the surface film, the zero reading is taken, and the time consumed in penetrating one centimeter, or any other convenient depth, noted. The time becomes the variable in this case and is easily and accurately determined. The penetration apparatus itself is very simple and capable of greater refinement in the test. The skin effect of some cements under certain temperatures is eliminated, as the penetration observed is that of the body of the cement alone.

To sum up: The paving cement should be stable, unaffected by oxidation, street fluids, the temperature used in mixing, chemical changes and interaction within itself. It should possess, throughout the entire range of temperature to which the pavement will be subjected, a fair degree of adhesiveness, that the particles of the mineral aggregate may be held in their relative position; a fair degree of ductility, that the pavement may accommodate itself to the expansion and contraction due to temperature changes; and a fairly uniform penetration, that the street may possess a uniform hardness and stability.

These requirements eliminate the

various coal tar pitches and fluxes high in the paraffine scale and narrow down to the better grades of asphalt products. Thus a good bituminous concrete pavement must necessarily be an asphalt concrete pavement.

We have then a pavement consisting of a hard and tough rock aggregate, fine enough so that the larger particles will not segregate in the raking and spreading on the street and graded so as to be inherently stable, having all the voids and interstices filled with an asphalt, sand and dust mortar in such a manner that the rock particles are thoroughly imbedded, and retained as well as cushioned in the matrix. Such a pavement will close fairly well under the roller and will need little if any surface dressing of the asphalt cement. It should have none smeared on the concrete base lest careless workmen put on an excess which will work up into the pavement and make it too soft.

The asphaltic mortar will have very much the same composition as a mix for standard sheet asphalt, except it will be richer in the cement, though the total mix will contain perceptibly less. The pavement will have all the advantages and desirable qualities of the sheet asphalt with its chief drawbacks—susceptibility to heat, softness, creeping and excessive wear—eliminated. With further improvement in the asphaltic cements, making them more adaptable to the wide range in temperature to which our pavements in the north are subjected, asphaltic concrete affords an ideal paving material.

I look upon bituminous concrete, or, as I should put it, asphalt concrete, as an improved form of the old asphalt pavement. It has been with us now long enough to prove its superiority. But because it partakes of a crushed stone aggregate, it need not go to the opposite extreme of being all stone graded to the elimination of voids except such as are to be filled with the bituminous cement. In this way it need not conflict with any patent rights, and is a far better pavement for not infringing or attempting to follow any patented formula.

The best pavement will have a rock aggregate with the voids ranging from 30 to 35 per cent. which are filled with the asphaltic mortar. Such a pavement will have all the stability necessary, yet have a quality of elasticity that adds materially to its life and wear. It will naturally take a little more cement or bitumen which, however, I consider a virtue, as the extra amount remains in store in the pavement replacing the natural loss due to oxidation and other possible causes.

Bituminous Concrete Pavements.

Discussion by George C. Warren, Boston, Mass.

MAY I be permitted for a moment to call attention to the fact that just ten years ago, Fred J. Warren, first brought to the attention of the public the theories of his new construction, from which theories the Bitulithic pavement has developed.

Then there was little except his theories, supplemented by two years' laboratory investigation; one patent issued and some twenty others pending and three pieces of pavement, aggregating less than 4,000 sq. yds., then in use less than six months and now more than ten years old and in first-class condition, with no repairs necessary during that period. At that time, every one said that the theories were novel. Most engineers agreed they were reasonable but all regarded them as largely experimental.

I think we can be pardoned for referring with pride to the result of a decade during which the pavement has been laid throughout the United States and Canada to the extent of over 19,000,000 sq. yds.

Finally, it is most gratifying to find such an able paper as that under discussio now proclaims "as most natural" principles so closely reiterating my brother's theory of ten years ago.

I want to express my entire agreement with the paper in the use of Portland cement and brick gutters on flat gradients in connection with bituminous pavements but from somewhat different reason than "deterioration from action from the street fluids." Any bituminous surface which depends on rolling for its compression cannot be laid to either as true a grade or as great a lateral slope as gutters should have, because the roller will, necessarily, flatten the lateral slope. The roller will also leave a slightly wavy gutter and water will not flow as freely as it should. Gutters of cement or brick set in concrete and grouted, on the other hand, can be laid to a straight edge to absolutely true grade and good lateral fall and allowed to set without being disturbed. My judgment and observation is that, generally

speaking, a width of gutter of twelve to eighteen inches and a lateral fall of one inch per foot is best.

The clear statement of the importance of "fixed cementing quality or adhesiveness" in the paper, is the first published statement I have seen on this important physical property.

About seven years ago Mr. A. E. Schutte devised, and, in Warren Brothers Company's private laboratory practice has regularly used, an apparatus for accurately testing the "cementing strength" of bitumen, measured by the breaking strain of compressed bars, made of sand of standard quality and size, cemented together with ten per cent. of bitumen. This test for "cementing strength" is the measure of co-hesiveness. Adhesiveness is the ability of the bitumen to hold the mineral together under stress. Co-hesiveness, or ductility, is the ability of the bitumen to hold its own particles together under stress. The two properties being closely allied, the results of the tests for ductility and cementing strength bear a close ratio to each other. We find that the materials sold on the market as asphalt vary as widely as one to twenty in ductility and one to five in cementing strength. In my judgment the value of the ductility test is not the ability of the material "to accommodate itself to the expansion and contraction due to temperature changes" as much as its indirect measure of cementing strength of the bitumen at varying temperatures.

No given bitumen has, to a maximum degree, all of the most desirable physical properties. In my judgment, the four essential properties of a bitumen are in the order named:

1. Cementing strength.
2. Ability to withstand moisture without deterioriation.
3. Range of flexibility at varying temperatures.
4. Purity, which is only scientifically valuable insofar as the impurities are soluble salts, organic or other matter liable to cause deterioriation, although from the point of view of economy purity is of vast importance.

As to the mineral aggregate, I cannot agree that mortar whether hydraulic or bituminous should ever be called concrete. There should be kept, a clear, sharp distinction and I hope the committee on nomenclature of the society will, in its report, preserve and clearly define the correct distinction which I understand to be as follows:

Mortar is a mixture of fine aggregate, sand or its equivalent, and a cementing medium.

Concrete is a mixture of coarse aggregate, stone or its equivalent, and mortar, and in the concrete, the coarse aggregate should predominate, and the fine aggregate be used in proper proportions to fill the voids of the coarse aggregate, and provide an overplus of say five to ten per cent.

Any "mongrel" combination should be classed as "mortar" or "poor concrete" as it most nearly approaches either of the above definitions. The term aggregate in hydraulic or bituminous cement includes all material in either mortar or concrete except the cementing medium and that, in concrete, it is divided into "coarse aggregate" and "fine aggregate." As the paper says, there is an analogy between a hydraulic cement and bituminous cement concrete but to avoid misinterpretation the terminology should be clear and distinct and no perplexing interchange of terms permitted or practiced.

(Samples of bituminous mixtures made under specifications requiring "bituminous concrete" and one of ordinary sheet asphalt mixture were shown and commented on as follows:)

All of these are properly "bituminous mortar" although containing a sprinkling of very fine stone. All are porous unstable mixtures carrying a high percentage of voids. The paper very clearly makes the proper distinction between "finer and inherently unstable aggregate" and "one which is coarser, graded as to size and inherently stable" and says "I consider it a natural evolution of composition pavements." In a sense that is true, and in a similar sense the telephone is the natural evolution of the telegraph, combined with the principle of hearing through vibration of the ear drum by sound, but that "natural evolution" made the telephone none the less novel.

Prior to the development in accordance with the patents under consideration the efforts to produce bituminous surface of coarse aggregate were along the line of laying the materials in layers thus closely following the principles of John Macadam in water bound stone roads. This was shown in the testimony in the litigation which has occurred.

Another statement in the paper, referring to hydraulic concrete, is that "no one thought of receiving a patent on the gradation of the mineral aggregate." Perhaps that is only because such grading of aggregate, as practiced in ordinary hydraulic cement concrete, was done before the world had come to appreciate the value to the community of encouraging inventions through allowance, for a short term of years, of a patent franchise.

The analogy between a hydraulic cement and bituminous cement concrete is by no means as clear as Mr. Lykken indicates, for the reason that in the hydraulic cement the bonding effect is produced by the chemical action or crystallization, which takes place when water is added to the hydraulic cement, while in the bi-

tuminous concrete the bonding is effected exclusively by the adhesive properties of the cement used, and the proper combination of the different sizes of the mineral aggregate, which latter is not at all essential in the hydraulic cement concrete, except as an element of economy in construction.

It is also a mistake to trace this analogy to "a development from the cement and sand mortar," for the reason that the whole tendency of the development of a bituminous cement and sand mortar was to produce "solidity," not "stability," by grading the fine particles down to still finer even by the use of a small portion of dirt or filler in the mixture. It was not until very much later and comparatively recently that the use of a coarser aggregate, properly graded as to sizes, was found to be possible with the use of a bituminous cement in the wearing surface of street pavement construction. It is this radical difference in the development of the latter day bituminous concrete construction, from that which had been practiced for years before, that made the issuance of a patent possible to the man who first made a practical demonstration of this radical difference in the construction of bituminous street pavement. The principal effect to be accomplished by the grading of stone in hydraulic cement concrete construction is economy in cost, whereas in the bituminous construction it permitted the use of a softer more durable cement and also added to the "stability" of the mineral structure itself, all of which advantages were novel in bituminous cement structures and were each covered by separate claims of the patent to which the paper refers.

The author says: "I mean here by stability resistance to pressure and displacement by flow or creeping." In this he clearly recognizes the essential difference between "stability" and "solidity" in the wearing surface of a bituminous street paving material, and brings out the essential ground upon which the validity of the patent to which he refers has been sustained by the courts; and that is that the use of coarser material and the proper grading of the mineral aggregate in a bituminous structure so as to produce "stability," "resistance to pressure and displacement by flow or creeping," had never been accomplished before, for the reason that the only effort prior to that time had been to produce "solidity" by the use of still finer material, which necessarily required the use of a harder shorter lived cement in order to hold the finer particles in place, which in themselves possessed no "stability" or power to "resist pressure or displacement by flow or creeping."

It was this broad distinction between "stability" and "solidity" as applied to the wearing surface of a bituminous street paving structure that enabled the inventor to secure a valid patent on a bituminous street paving structure having "stability," a minimum of voids, and permitting the use of a softer and more lasting cementing material, but which would not have justified the issuance of a patent on the same character of construction with hydraulic cement.

The fundamental error in the paper, as it seems to me, is the assumption that the development of "an inherently stable aggregate in the modern conception of the good hydraulic concrete" would seem equally natural in the development of bituminous concrete, and is due to a total failure upon the writer's part to distinguish between the above described functions which "an inherently stable aggregate" performs in the two classes of construction.

That the author of the paper under discussion and others skilled in the paving art should now come "to look upon bituminous concrete as an improved form of the old asphalt pavement," and regard its superiority of construction, now that "it has been with us long enough to prove its superiority" as a self-evident fact so simple that every one must have known it, is the highest evidence possible of the real invention and patentability upon the part of the person who first "proved its superiority" in the face of the most bitter and relentless opposition from those engaged in laying "the old asphalt pavement" or what Mr. Lykken correctly terms "an asphalt mortar."

Returning to the importance and size of aggregate for the wearing surface of bituminous concrete, the paper suggests that the maximum size of the mineral aggregate should be for a wearing surface two inches thick, "one and one-half inch mesh"; again the "maximum size eequivalent to half the depth of the finished layer," and again "approximately one-third the depth of the pavement layer." Our practice on this point has always been to have the maximum sized stone in the aggregate forty to fifty per cent. of the thickness of pavement surface, except that on crushed stone or bituminous base a larger sized stone may be used, because a considerable portion of the larger particles of aggregate will crowd down into the spaces between the corners (generally three-inch stone) in the foundation and in reality make the total wearing surface fifty per cent. greater than the two inches specified. Incidentally this is one of the advantages of bituminous base above referred to, provided the subsoil is of a character which can be rolled solid. The very first pavement laid under our patent (Park Place, Pawtucket, in May, 1901) was laid on an old tar pavement to a thickness of one and one-half inches and

the largest stone passed a three-fourths inch ring,—say one-half-inch stone or one-third the depth of the pavement surface. I agree with the suggestion of the paper that the smallest sized stone might be one-third the thickness of the surface, which provides, with a two-inch surface, maximum stone two-thirds of one inch size (say passing a one-inch ring), would not be bad practice, although stone up to passing one and one-quarter-inch ring, say one-inch stone, could be used with equal propriety

The idea which people have, and which has been pushed in legal attacks on the patents, that they are confined to a certain sized maximum stone is entirely erroneous. For instance, one patent, referring to stone up to three inches, also says the surface may be laid to any thickness but a thickness of one to three inches is preferred. Surely that carries with it the clear idea of the inventor and the patent that the maximum sized stone may be less than one inch because it is impossible to lay a one-inch surface using stone greater than one inch size.

The fundamental point of the basic and adjudicated patent is that the aggregate shall not be so proportioned as to provide "inherent stability" or "less than 21 per cent. voids." Note that the two points are separate and are covered by distinct claims and that the two points may not necessarily be, although they generally would be, in the same structure. The most accurately graded aggregate with maximum sized stone about two-inch size will have voids as low as ten per cent. The only limit as to maximum size of stone in this patent is that it shall be "greater than one-fourth inch."

The closing paragraph of Mr. Lykken's paper clearly shows how closely his ideas conform to the patent and practice. The paper provides for "a rock aggregate with the voids, ranging from 30 to 35 per cent., which are filled with the asphaltic mortar." Let us briefly analyze this:

Voids in rock	30 to 35 per cent.
Provides coarse aggregate equivalent in weight to solid rock	70 to 65 per cent.
Assuming the mortar to contain at least enough bitumen to coat the particles of all aggregate both coarse and fine, it would have about twenty per cent. bitumen and yield fine aggregate (sand or stone finer than 1-10 inch)	24 to 28 per cent.
Bitumen	6 to 7 per cent.
Total	100 per cent.

Reducing this to percentage of aggregate, exclusive of bitumen we find:

Coarse aggregate, which the paper defines as coarser than 1-10 inch.	75 to 70 per cent.
Fine aggregate, passing No. 10 screen	25 to 30 per cent.
Total	100 per cent.

I think it is better practice to consider everything passing one-fourth-inch mesh as "fine aggregate" and that remaining on one-fourth-inch mesh as "coarse aggregate."

Mr. Lykken's formula would provide compacted mineral aggregate having from 10 to 15 per cent. of voids, depending on the grading of the aggregate within the general proportions specified, and depending on the character of stone used and the kind of crusher used for producing the crushed stone, and would most clearly come within the specifications and claims of the patent referred to and would produce a very high degree of "inherent stability" and low percentage of voids.

Roads in New Jersey and their Repair.

By James Owen, Consulting Engineer, Newark, N. J.

THE state of New Jersey may be considered the pioneer State for systematic road development. As far back as 1868 the legislature passed a law enabling Essex county to lay out and improve roads in that county. Taking profit by that example other counties followed suit and many hundreds of miles were constructed in northern Jersey, under either the macadam or Telford process with trap rock as the material.

Stimulated by the example of the different counties the local municipalities also began a systematic construction on the same lines.

Nearly twenty years ago the State Aid law was passed, the first in this country, providing that the state should pay one-third of the cost of construction, the town ten per cent. and the balance by the county. This so stimulated the construction of roads that it may be confidently stated

that up to date New Jersey has a greater proportion of hard roads than any other state.

For road purposes the state may be divided into two districts, the northerly part with only stone available, and the southern part with nothing but gravel. In the early practice gravel did not find much favor, and so miles of stone roads were built in the gravel country, but with later experience this practice has been modified.

In the early days of road construction and maintenance iron tires and horses' hoofs were the only irritants to be considered and experience finally gave good results economically and physically in the shape of a good, hard, smooth surface at all times when repairs were systematically made. It must be said, however, that the subject of maintenance was not always looked upon as a necessity, and in some sections the roads were allowed to deterioriate.

The stone used in the northern part of the state was chiefly trap rock, the best for such work. Where granite was available, it was used, but as the granite was in the less populous districts there was consequently less travel, and the results of the use of the two materials were about even.

Up to eight years ago the roads of this state were accepted as ideal and were noted throughout the land. Their condition was inviting, and of course travel increased, but their condition remained excellent until the automobile entered the scene. At first, when there was but a small number of cars, their effect was not apparent and no appreciable change was noted in the surface, but as they increased in numbers two results were clearly shown, the ravelling of the surface and the volume of dust. The first condition was only appreciated by the person in charge of the roads, but the second became a public menace and popular demand immediately arose for the suppression of the dust nuisance. This point must be strongly noted, as if the dust question had not arisen with the force it did, the maintenance of the road for the automobile travel alone would not be so complicated.

With this popular demand for dust suppression, there arose in the market every possible panacea for the evil. Each had its earnest advocate with alluring argument and instances of sporadic success. The average road man, whether constructor or maintainer, was at sea, as he had had no experience in these new curatives and could not appeal to his likes for help. Consequently the only thing to do was to experiment, and this country, and it may be said the entire civilized world, is still experimenting, and it is to be hoped that in the early future some crystallized practice may be evolved that will give at least ninety per cent. efficiency instead of about forty.

The writer has experimented with all kinds of asphaltum oils, heavy and light, with calcium chloride, dustolene and Tarvia, and noted results, arriving at the following conclusions:

That for economical reasons the road maintenance of the country can not be vested in experts using material requiring expert approval. That a system must be evolved that can get good results with ordinary common intelligence. That under the old system of construction and maintenance, such results were achieved, not, of course, universally but generally. That a mere modification of the old regime suitable to automobiles and dust suppression is all that is necessary.

The experience arrived at in this section is, build your roads in the same old way, viz: of water bound macadam or gravel and repair them in the same old way. This insures a smooth surface which was hard to get in the heavy oil mixtures. Then coat according to its travel, with light oil with not more than 38 per cent. asphaltum, as often as the necessities of dust suppression require. This is what is now being done in this section and gives a smooth road with no dust at the cheapest cost.

Giving figures as a basis, the old roads, prior to the automobile, with city, suburban and rural travel, cost three cents per square yard per annum. Increased cost of material, labor, population and wear has increased this amount to from five to six cents, application of oil, one cent; improved asphaltum or other binder surfacing, two or three inches thick, costs on an average one dollar per yard. This must last twelve years to equal the other practice and must also keep a smooth surface, which many of them do not.

Another trouble is that with the use of improved surfaces costing one dollar per yard, the appropriation is so cut into that much needed repairs are entirely neglected, causing much dissatisfaction.

Distributing and Mixing Machinery for Construction and Maintenance of Bituminous Pavements and Surfaces.

By Arthur H. Blanchard, M. Am. Soc. C. E., Professor of Highway Engineering, Columbia University, New York City.

THE increase in the use of bituminous materials in the United States during the past four years has been phenomenal. For instance the State Highway Departments of Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania and Rhode Island in 1908 used bituminous materials in the construction and maintenance of 416,000 sq. yds. of road surface while in 1910 the total was 18,244,000 sq. yds.

With the increase in the use of bituminous materials in the construction and maintenance of highways there has arisen the demand for economical and efficient machinery. The development of machinery in Europe has been much more rapid than in the United States as it was practically ten years ago that Dr. Guglielminetti started the effective campaign against dust at Monaco, while American engineers have only used bituminous materials in country road construction for about five years.

The fact that a large percentage of the work both in the United States and in Europe has been done by surface treatment or penetration methods has led to a greater development of distributing machines than of mixing machines. The relative advantages of the different methods of construction and maintenance will not be discussed in this article, but it is of interest to note that the use of the mixing method is increasing, due to the introduction of machinery with which this class of bituminous pavement can be constructed both economically and efficiently.

Distribution of bituminous materials by hand methods for both superficial treatments and penetration work is generally accomplished as follows: by pouring pots; by hose attached to some type of pressure tank; by small kettles fixed to wheels and pushed by hand; by brooms which are supplied with bituminous material through a hose which is connected with a tank.

Steel tank wagons of 600 gallons capacity equipped with steam coils or other means of heating the material and with appropriate fittings so that pressure may be obtained within the tank have been used to some extent in the United States for distributing tar and tar-asphalt compounds in constructing roads by the penetration method. A flexible hose with a nozzle is attached to the outlet valve of the tank by means of which the material is applied to the road. The tanks are hauled by a steam roller which not only supplies steam for heating the material in the tank, but also furnishes the steam for the pressure. The pressure is obtained by admitting the steam into the tank above the bituminous material, the latter being forced out by the pressure of the steam between the material and the top of the tank. By an arrangement of the piping system, means are provided at the outlet valve of the tank so that the steam can be admitted to either side of the valve. The valve or the hose can be easily and thoroughly cleaned out before the distribution of the bituminous material is commenced by simply allowing hot steam to pass through the same. Several types of nozzles at the hose end have been tried. One form is the round pipe with the outlet flattened to a slot. This nozzle does not throw as good a spray as a special nozzle, cast in such a form that the material is given a twisting motion just before it leaves the nozzle, resulting in a cone shaped spray. Two men are generally used with this machine besides the man on the roller. One man is at the nozzle end of the hose and the other clasps the hose about midway of its length, and drags is around as the nozzle man distributes the material.

The European machines of this type, used principally for superficial treatments, are of much smaller capacity, and are either drawn by hand or by horses. The capacities of the machines range from 50 to 320 gallons. Essentially these machines consist of a tank for holding the material, the tanks being heated by direct fire, a semi-rotary pump with a length of suction hose attached to the tank for the purpose of filling the latter and another pump attached to the tank by which it is possible to generate a pressure between the pump and the nozzle. The material is pumped from the tank through a length of flexible hose to the outlet end of which is fixed an iron pipe fitted with one or more nozzles. The nozzle is of such a form that the material is thrown in a fine cone shaped spray. When the machines are equipped with five or six nozzles they are so arranged that a two foot width of surface can be covered at a time, the nozzles being fixed to a pipe on two small wheels. When one or two nozzles are used, the distribution is effected by passing them over the road surface, the pipe being held up by the

I. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Studebaker Hot Road Oiler.

II. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
A. T. C. Distributer.

men. Both the pump for filling and for pressure are operated by hand, hence it takes at least two men to operate this type of machine, one to run the pressure pump while the other manipulates the hose.

Distributers drawn by hand, consisting of small kettles mounted on wheels, are usually of the gravity flow type, the "Eldus" being typical of this class of machine.

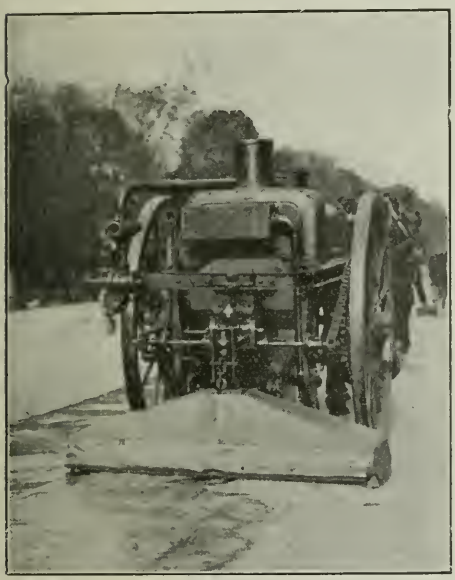
The fourth method mentioned is accomplished by means of a special form of broom known as Wathman's Reservoir Broom and is adaptable only for superficial treatments. This apparatus comprises a kettle in which the material is heated and to which are fitted two lines of flexible hose, each of which is attached to the head of a hand push broom. The tar flows through this flexible hose into the head of the broom and is thence swept into the road by the men operating the brooms. One man pulls the tar kettle, two work the brushes behind the kettle and a fourth man supplies the kettle with fresh material.

III. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Perfection Distributer and Heater.

Distributer machines may be readily divided into two general classes, that is, the gravity flow type and the pressure type. Watering carts were first used in the United States for distributing the light oils and tars for suppressing the dust. The ordinary spray attachments on the carts were not very satisfactory for distributing this class of material. Attention was then directed to modifying the distributing device, still using the wooden tank wagon. Practically all of the modifications consisted in substituting for the improved type of water sprinklers one or more horizontal pipes pierced with small holes. These pipes were attached to the outlet pipe of the tank and were placed parallel to the back axle at the rear of the tank. The pipes were usually about the same length as the gauge of the rear wheels. The material flowed through these pipes in small vertical streams onto the road surface. In distributing small quantities the road surface would not be entirely covered with the material but the streams would be separated by the distance between the holes in the distributing pipes. Traffic would work the material around on the road surface so that in the course of time a fairly satisfactory result might be obtained. The materials were of such a consistency that they could be applied cold. Larger quantities of the material could be distributed by bringing into use at the same time more of the horizontal distributing pipes. This type of apparatus is used to some extent at the present time in the United States.

The general practice in Europe in using machines of this type is to follow the distribution by brushing the material into the road. This is either done by hand

brooming or by brooms which are attached directly behind the distributer. The brooms are either of the drag or rotary type. The machines are made to be drawn by hand or by horse. They consist essentially of some form of iron tank having capacities of from 50 to 320 gallons, mounted on wheels, with the distributing attachment at the rear. This attachment consists of horizontal pipes pierced with holes similar to the arrangement described above. The purpose of the brushing is to distribute the material evenly over the road surface and, in applying small quantities of material by a gravity flow machine, it is the only way



IV. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Hedeline and Voisembert Pressure Distributer.

of accomplishing this object. Most of these European machines of the larger sizes are provided with fire boxes for heating the material and with semi-rotary pumps for filling the tanks. The smallest sizes are found to be very advantageous in repair work. The Lassailly and Weeks machines are illustrative of this type of distributer.

As the demand developed for a heavier binder, both for surface treatment and penetration work, machines especially designed for distributing these materials began to appear. The market at the present time in this country is supplied with so many different types, each one of which is claimed to be "the distributer," that a thorough investigation is an essential preceding the acquisition of machines for various classes of work. Among the American distributers of the gravity flow tyje may be mentioned the following: the Studebaker improved road oiler; the Studebaker hot oil machine; the A. T. C. distributer; the Topping oil sprinkler and distributer; the Perfection distributer and heater; the Perfection distributer; the Good Roads Improvement Company distributer.

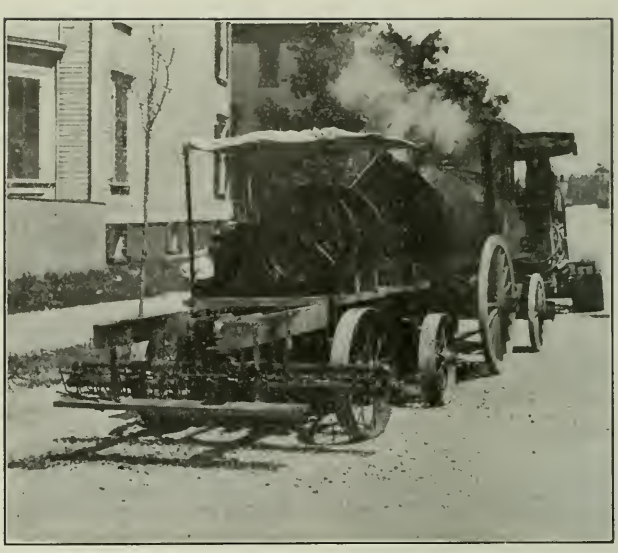
The Studebaker improved road oiler consists of a steel tank wagon of at least 400 gallons capacity to the back of which are fitted three horizontal distributing pipes, which are parallel and are fed by two large pipes from the tank. Levers are provided for the control of the outflow and are operated by a man on a seat which extends out beyond the pipes. The material flows out of holes bored in the horizontal distributing pipes. This machine is generally drawn by two horses.

The Studebaker hot oil machine, Plate I, is a 500-gallon steel tank with practically the same type of distributing apparatus as is used on the Studebaker improved road oiler. To obtain uniform distribution a splash board attachment has been provided. The tank is provided with tubes placed vertically throughout the interior, through which heat is conveyed to the material within the tank. The heat is obtained by means of oil burners placed in a fire box which is the full size of the bottom of the tank.

The A. T. C. distributer, Plate II, is a small trough mounted on two wheels which is intended to be attached to the rear and underneath the outlet valve of any form of tank wagon. Leading from the trough to a horizontal distributing pipe near the ground are three vertical pipes. The horizontal pipe is fitted with nipples through which the material flows onto a splash board and thence falls to the road surface in a continuous sheet. This machine requires one man to manipulate the distributer.

The Topping oil sprinkler and distributer is a distributing device designed to be attached to any form of tank wagon. The horizontal distributing pipe is made up of two separate sheet iron cylinders fed from the cart by two pipes in the form of an inverted V. The material flows into these cylinders, and by means of levers, the outlets of the cylinders are so controlled that a sheet of the material can be spread upon the road. The levers are controlled by a man who sits on a seat over the distributer.

The Perfection distributer and heater, Plate III, consists of a portable 350-gallon tank, at the rear end of which is fixed the distributing apparatus. The material flows through two pipes into a pipe with rectangular cross-section, which extends



V. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Ward Pressure Distributer.

VI. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Pillsbury Pressure Distributer.

the full width of the tank, and from this compartment through a V shaped trough onto the road surface. In this manner the material is applied to the road in a continuous and unbroken sheet. The distributing apparatus is provided with levers and valves for the control of the flow of the material and is operated by one man on a seat over the distributer. This machine may be either drawn by horse or by a steam roller. The tank has a fire box extending underneath the tank for its full length and is heated by means of a direct fire. The distributing apparatus is also cased in and connected with the fire box so that, if it is desired, heat may be passed around all of the pipes even while the machine is distributing the bituminous material.

The Perfection distributer has exactly the same form of heater, but it is not cased in and is attached to a 600-gallon cylindrical tank wagon. This tank is provided with a small fire box for the purpose of heating the material in the tank. The tank wagon is horse drawn.

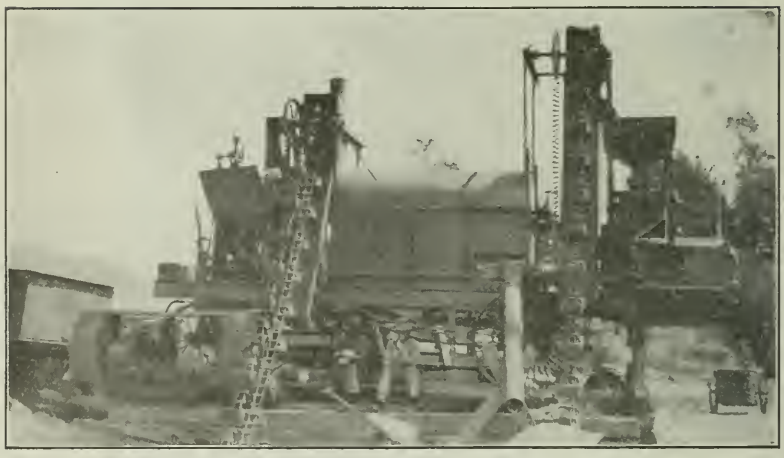
The Good Roads Improvement Company distributer is similar to the Topping in that it is designed to be attached to any form of tank wagon. The material flows through two pipes connected with the bottom of the tank wagon to the horizontal distributing pipe. The amount of the material distributed is controlled by the man operating the levers who rides on a seat over the distributer. This same company has also designed a special form of heating apparatus consisting of kerosene oil burners. It is so arranged that it can be attached to any form of steel tank wagon without any riveting being required.

One of the most famous pressure machines in Europe is known as the Aitken distributer. This machine consists of a tank at the rear end of which is fixed a small cylindrical pressure tank connected with the air and tar pump. The quantity of air and tar admitted to the compression tank can be easily regulated. The material is sprayed on the road through a horizontal distributing pipe fitted with spraying nipples. Where large areas have been covered by superficial treatments, this machine has given excellent results in England. The tanks are provided with means of heating the bituminous material. There are other makes of pressure distributers which omit the compression tank, the material being pumped direct from the tank by a force pump situated between the tank and the nozzles. The Hedeline et Voisembert pressure distributer, Plate IV, is a machine of this type.

Several types of pressure machines have been invented in the United States, the most widely known being the Ward distributer, the Johnson distributer, the Pillsbury distributer, the H. P. spreader and the Standard Oil Company's distributers. The distributing devices of all of these machines are alike in having horizontal pipes fitted with nozzles. The ma-

VII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Gasoline Engine Distributer of Standard Oil Co.

VIII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Smith Hot Mixer.



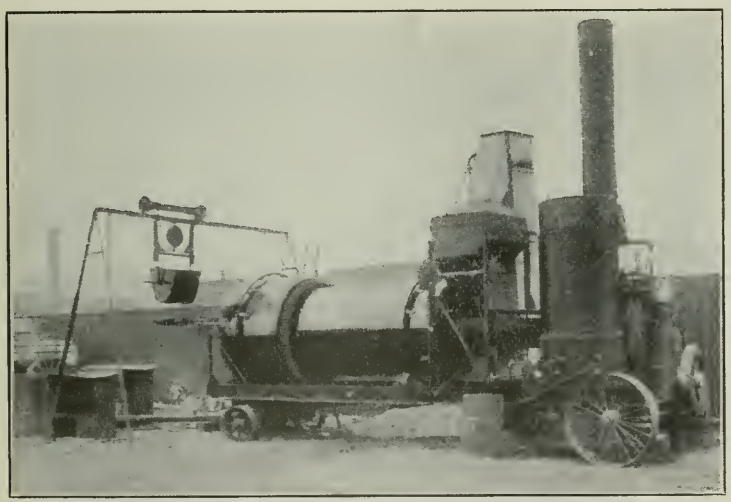
IX. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Iroquois Self-Propelling Asphalt Concrete Mixing Plant.

chines differ somewhat in the way the pressure is obtained and applied.

The Ward distributer, Plate V, employs a gasoline engine and pump which is either attached directly to the tank or placed on a separate carriage. The pump is placed between the tank and the distributing pipes and draws the material from the tank and forces it through the nozzles at a pressure of about 30 to 50 pounds.

The Johnston distributer is separate from the tank wagon and consists of a steam pump mounted, together with the distributing pipes, upon a truck. For its operation it requires, of course, a steam roller, which furnishes the steam for the pump, the roller drawing the tank wagon and the distributer. The truck to which the Ward distributer. In this machine the pressure is obtained by means of a gasoline engine and pump attached to the rear of the tank wagon. In another type of machine the pump is run by a sprocket drive from the rear wheel. The Standard Oil Company have also used to some extent a large automobile truck fitted with a tank for holding bituminous material and a pump driven by the engine for developing the requisite pressure. None of these machines have means of heating the bituminous material.

For many years in connection with the sheet asphalt paving industry mixing plants have been in use. A complete plant of this sort consists of a sand dryer and storage bin, kettles for melting bituminous material, and a mixer capable of



X. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Warren's Portable Asphalt and Repair Plant.

the pump and distributer are attached has a steering wheel so that the man operating the distributer may guide it independently of the roller or tank wagon. The H. P. spreader is similar in construction and in method of operation to the Johnston distributer.

The Pillsbury distributer, Plate VI, is attached to a specially designed steel tank wagon capable of containing steam under pressure. The tank wagon is drawn by a steam roller, the boiler of which is connected with the tank wagon, furnishing pressure on the bituminous material in a manner similar to that described for the pressure tank wagons and hose distributers.

The Standard Oil Company have used a distributer, Plate VII, which is similar to mixing the sand and bituminous material together, all suitably arranged so that the operations follow one another in such a manner that none of the ingredients of the mixture have to be handled by hand from the time they are placed in the receiving end of the machine until they leave the outlet end. Such plants are now placed permanently on flat cars as one or two car portable plants. During transportation the plant is housed and when the car is drawn up on a siding the machinery may be rapidly prepared for work. The mixing device of this type of plant consists of a semi-cylindrical trough for holding the materials to be mixed together. A series of paddle wheels revolve on a horizontal axle which is fixed at either end within the trough. These pad-

dles agitate the ingredients and thus produce the mix.

To meet the demand for a mixing plant with which various types of mineral aggregates can be economically mixed with bituminous material, several machines have been designed in this country. The requirements of engineers vary to a considerable extent due to the different kinds of aggregate employed; that is, in some cases, one size crusher run stone is used; again combinations of broken stone and sand are employed; while in many instances a carefully graded aggregate is specified. The following machines have all been used in connection with the construction of bituminous pavements of the above types: the Link-Belt portable asphalt paving machine; the Smith hot mixer; the Guelich portable asphalt plant; the Iroquois self-propelling asphalt concrete mixing plant; the Warren Brothers' Company portable mixing plant.

The Link-Belt machine is made in two sizes and mounted on four wheels for transportation purposes. The large machine is about 27 feet long and weighs approximately 17 tons. Practically all of the mechanism is housed in. It consists of melting kettles, a dryer, a dust blower and a mixer. The material is shovelled into one end of the machine, passes through the dryer and thence into the mixer, where it is mixed with the bituminous materials. The power for operating the machine is obtained by belting it to a road roller or a traction engine. The heat for the dryer, the melting kettles, etc., is obtained by means of fire boxes underneath the machine, in which coal is burned as fuel, the hot air passing around the various parts of the machine.

The Guelich mixing machine is a batch mixing machine of a somewhat similar type. It consists of small storage hoppers for the different materials, a dryer and a mixer. The mixing device in this machine is somewhat unique in that it is a cylinder which revolves around fixed paddles. This machine is furnished with a small engine capable of developing the requisite power for running the machine and has a fire box by means of which heat is obtained for keeping the dryer and the mixer hot. It is mounted on four wheels and can be readily transported from place to place by a steam roller or other tractor.

The Smith mixer, Plate VIII, is an ordinary Smith cement concrete mixer modified to meet the demands of the work. The mixer, boiler and engine are all mounted on a four wheel truck. The heat is passed into the mixer by means of a large iron pipe, which runs from the fire box to the outlet end of the mixer. A blower is attached to the fire box so that the hot gases can be forced through the pipe and mixer. An automatic loading skip run by the same engine which runs

The Iroquois plant, Plate IX, is mounted on a four wheel truck and consists of an engine and boiler, a dryer and mixer. The stone is raised by means of a chain elevator, passed through the dryer and out to the ground again where it is raised by another chain elevator to hoppers placed over the mixer. The mixer itself is heated by a small steam jacket underneath the bottom. The mixer is of the same type

XI. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
American Tar Company's Tar Coating Machine.

XII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Barrett Mfg. Co.'s Hose Pressure Distributer.

XIII. BITUMINOUS ROAD CONSTRUCTION MACHINERY.
Hand Distributer with Perfection Pouring Can.

as described under asphalt paving plants.

The plant connected with the Warren Brothers' portable mixing machine, Plate X, consists of a boiler, oil burning apparatus, hoppers, elevators, dryer and cylindrical mixer. In operation the measured aggregate is deposited in elevators which carry it to a storage bin from which it flows to a dryer and after a varying interval is dumped into the mixer. The bituminous material is introduced into the mixer above the discharge outlet.

Two machines which have been built in Europe for a similar purpose are the Ransome-ver Mehr and the Aeberli. The Ransome-ver Mehr is simply a mixing drum with open top and circular bottom provided with two axles which are fitted with steel arms constructed on the hit or miss principle. If desired the ends of the drum can be steam jacketed. The mixer discharges through the bottom of the mixing drum. The machine is mounted on a four wheel truck. By means of the Aeberli

machine the broken stone is dried, cleaned and finally passed through a bath of cold tar.

A tar coating machine that has been used in this country to some extent is that of the American Tar Company. This machine, Plate XI, is a long trough with an incline at each end, equipped with a fire box and mounted on wheels. Under the middle portion of the trough three hot air pipes pass through the bituminous material. The cold material is introduced in either of two jackets on the sides of the trough, which jackets form a continuation of the compartments beneath the trough. The hot material rises in the jackets and passes into the trough through holes in the inside walls of the jackets. Cold stone is placed on one incline and raked there into the hot bituminous material, and then onto the other incline under which there is a hot air bath, by the aid of which superflous material is drained off.

In this paper no attempt has been made to give the limits of quantities of various materials which can be applied by any of the different distributers or the nature of the output of the various mixing machines. The efficiency of distributing and mixing machinery is a function of many variables, among which may be mentioned; the kind of bituminous material and mineral aggregate used, climatic conditions, the type of construction or maintenance employed, the amount of work to be accomplished, plant arrangement and labor organizations.

Brick Road Construction About Cleveland and Buffalo.

Editorial Correspondence.

THE use of brick in country road construction, while not limited to the northern portions of Ohio and New York, has been brought to its highest excellence in that region. The vicinities of Cleveland and Buffalo have been improved by the building of brick roads, to a degree that it is possible to travel for miles in the neighborhood of Cleveland and to enter Buffalo by most of the main thoroughfares, upon roads which are surfaced with brick. Cuyahoga county, Ohio, in which Cleveland is located, has over three hundred miles of these brick roads. The county possesses conditions which present about every problem of road construction. The soil is of a sticky yellow clay with occasional outcropping of rock. The variety in topography is about as marked as is the soil, some of the roads being so level that the drainage is the most serious problem to contend with; while others are so rough and broken that, in order to procure a feasible grade line, the cost of excavation becomes an important consideration.

By reason of the fact that the city of Cleveland was situated within the county, it became possible to build a form of road which was high in first cost; and it also made necessary the construction of permanent roads to allow of the heavy hauling into and out of the city. The Ohio road law of 1908 provided the means of obtaining substantial roads in Cuyahoga county, and the proximity of excellent paving brick led to the adoption of this material.

The old style of 8-foot brick pavement, with its base of sand or gravel, had its trial in the vicinity of Cleveland. This was followed by the 14-foot standard road with a slag or crushed stone base and sand cushion; and this in turn was superseded by the grout-filled pavement laid on a concrete base. The first road built according to this standard was laid in 1905, in the village of Brooklyn. A 4-inch base was at that time deemed sufficient.

The most recent form of construction, and one which has reached a degree of excellence superior to any brick road construction of the present time, is according to the National Paving Brick Manufacturers' Association specifications. This construction provides for a 14-foot roadway, concrete curbs, a 4-inch concrete base, a 2-inch sand cushion and a "one-to-one" cement grout filler. The drainage is provided for by giving the whole pavement a pitch to the outer curb and a slight crown.

A number of roads have been constructed according to this general standard. A notable instance of this more recent construction is the Dunham road shown in an accompanying photograph. This road was built about five years ago, and at the present time is in excellent condition. One criticism, or rather apprehension, which has been expressed, regards the construction of permanent brick roads with concrete curbs, directly along a dirt road. It was stated that the traffic in passing from one road to the other would cause a rut to form along the curb, which in turn would be worn and

DURHAM ROAD, CUYAHOGA COUNTY, OHIO.
Laid Five Years Ago on a Concrete Base.

NORTH RIDGE ROAD, CUYAHOGA COUNTY, OHIO.
Laid Five Years Ago on a Broken Stone Base.

broken, and in time work away from the brick surface. That this is by no means the case is noted from the photographs given herewith. There are also a number of examples of roads, some of which are eight or ten years old. These latter, most of which were laid on a stone or slag base, are in very excellent condition.

It has been noted in these pages and in other instances where comment has been made on the Cuyahoga county roads that there were a number of cases in which longitudinal cracks had formed in the center of the brick roads. At the time of the official inspection of these roads in 1910, by a committee of municipal officials, it was stated that in all probability these cracks would deepen and chip along the edges, causing a rut to form along the center of the roadway. This fear has proven, up to the present time, to have been groundless. The longitudinal cracks, except for a few isolated cases where soft brick have been used, are not more pronounced than at the time of the inspection. In a few cases the local officials have caused the cracks to be filled with some sort of pitch or asphalt filler; and in every instance of this kind the chipping of the edges has been as marked as in those where there was no attempt at repair. Where cement

grout has been carefully applied the small amount of deterioration along the cracks has been stopped.

The reason assigned by Will P. Blair, secretary of the National Paving Brick Manufacturers' Association, for the formation of these longitudinal cracks is imperfect drainage in the subgrade. With a view to correcting the defects due to this factor the following recommendations have been made: "For draining the roadbed in most soils a small tile, laid parallel with the curb with 'T' outlets at intervals of every ten feet, will answer. If, however, the soil is of such character that the water by capillary attraction fills to the uttermost then, to avoid frost action incident, it is necessary to run two lines of tile along the curb lines, with diagonal drains placed at frequent intervals and 'staggered'." Mr. Blair also recommends the use of one-inch expansion joints along each curb, wider joints being used as the pavement width is increased.

The more recently constructed Cuyahoga county roads, as well as many of the older roads, are entirely free from any defect; even the longitudinal center cracks noted above. The proportion of poor roads among the older brick highways in the vicinity of Cleveland is very small, and among those constructed under the new standards there are no examples of poor construction.

In the vicinity of Buffalo the brick road has been almost universally adopted by the state road department. It is stated in this connection that the immense volume of heavy traffic and the combined wear of the automobiles and the heavy trucks and wagons demand a smooth, permanent roadway. These factors, connected with the fact that the city of Buffalo pays the larger portion of the taxes made necessary by the cost of these roads, led to the adoption of brick in this region.

The road construction in the vicinity of Buffalo has been in charge of W. C. Perkins, resident engineer of the New York State Highway Department, and a force of twelve assistants. To the careful and efficient supervision of the engineering department may be ascribed the excellent results obtained on the roads in question.

One example of the Buffalo brick road work is the Williamsville road, of which a number of photographs are here shown. This road was constructed late in the fall of 1910; in fact, some of the work was done during freezing weather; but due to careful and efficient attention of the engineer in charge no bad effects resulted. This stretch of road at the present time is in excellent condition. It is smooth with even joints, which are filled flush to the surface but not "flooded"; and except for a few instances is free from the center cracks referred to in connection with the Cleveland roads. The few instances of center cracks have been carefully dealt with, and it is probable that no further trouble will result on that score. In speaking of the tendency towards longitudinal cracks in the center of the pavement, Mr. Perkins stated his

THE BUFFALO-WILLIAMSVILLE ROAD.
Leveling the Sand Cushion.

belief that the trouble was due to the heaving action of frost in the ground, and in support of his statement gave some instances of undoubted frost action. He suggests as a possible remedy the construction of the concrete base with a flat bottom and a curved top conforming to the crown of the pavement. In this way the line of weakness; i. e., the top of the arch which fails under upward pressure will be eliminated.

In the Williamsville, as well as in a number of other New York brick roads, "wire-cut-lug" brick have been used. These brick are as their name indicates cut to a regular form by means of wires and are not repressed. They are very regular in size and shape, have square edges, are imbedded firmly in the filler and appear to give a more even surface and straighter joints than do the repressed brick. It was noted on one road, which was being rolled preliminary to applying the grout, that the roller had caused a spalling or flaking of the edges of the newly-laid brick. What was the cause of this, the writer is not prepared at the present time to venture.

The specifications under which the New York roads are being laid differ in some respects from those in use in Ohio. In the case of the roads in the vicinity of

THE BUFFALO-WILLIAMSVILLE ROAD.
Rolling—Preliminary to Applying the Grout.

THE BUFFALO-WILLIAMSVILLE ROAD.
The Completed Road Ready for Expansion Joints.

THE BUFFALO-WILLIAMSVILLE ROAD.
Applying the Grout According to the N. B. M. A. Specifications.

Buffalo, the pavement is laid with the two curbs at the same elevation, and a crown of one-fourth-inch to the foot is provided. A 1½-inch expansion joint is allowed at each curb in the case of a 16-foot roadway, which is considered standard. The sand cushion provided is only 1½ inches instead of 2 inches, as in the case of the Cuyahoga county roads. The reason given for this is that less rolling is required; and as one engineer on the New York work stated, "We make up the difference by raising the low ones and bedding the high ones."

One practice which is almost universally followed on the New York work and which is condemned in the National Paving Brick Manufacturers' specifications is that shown in the accompanying photograph; namely, that of "dumping" the grout box instead of scooping the mixture over the pavement. The engineers in charge state that the results obtained are as good as if the slower method was used. It is doubtful, however, if this is the case, as it seemed that the flood of material as it was dumped from the box caused an unevenness in the amount of the grout which found its way into the joints; and it is probable that some joints were imperfectly filled. It was noted, also, that the pavements of which the joints were filled by dumping the boxes had an excess of filler on the surface of the brick, a fact which was not true of the pavements which were treated in the other manner. The second grout coat is added by dumping the grout box and brushing the material into the joints with rubber "squeegees."

MAIN STREET ROAD, BUFFALO, N. Y.
Applying Grout by the Incorrect Dumping Method.

EDITORIAL COMMENT

The American Association for Highway Improvement.
Central Utilities Commission and Home Rule.
Standardizing Specifications.

THE AMERICAN SOCIETY FOR HIGHWAY IMPROVEMENT.

The first convention of this new society, not yet a year old, will be held in Richmond, Va., November 20 to 25, 1911. Some idea of the program has already been given in MUNICIPAL ENGINEERING, and further details will be found in the news departments this month.

This is the first society devoting itself to highway improvement which has stated its intention to keep itself free from entangling business, personal and political alliances, and thus far has fulfilled its promises. All sides of the road problem will be presented on the different days of the convention, and men of all shades of interest in the subject will find the convention well worth the trouble and expense of the trip.

President's day with an address by President Taft has other addresses by prominent men interested in the good roads problem from its effect on the development of the country. The engineers have a day for the discussion of the technical problems; the road users have their day, and so on through the list of classes of men devoting themselves to good roads.

The automobilists are preparing for automobile trips from all directions to Richmond and will be there in full force.

This association is affiliating with itself the state, local and district good roads associations and clubs, and is preparing for a general concerted forward movement all along the line. Field agents are busy answering the calls for help in developing local sentiment and in organizing local clubs and associations. The association has the benefit of close touch with the Office of Public Roads of the United States Department of Agriculture, and the two organizations are co-operating in every way possible. The president of the association is Logan Waller Page, who is in charge of the Office of Public Roads. J. E. Pennybacker, Jr., Colorado Building, Washington, D. C., is the secretary. Either will send full information about the association on request.

CENTRAL UTILITIES COMMISSION AND HOME RULE.

In a paper before the Madison Literary Society, Mr. B. H. Meyer, recently chairman of the Wisconsin Railroad Commission, discusses the effect of the regulation of public utilities by state commissions upon the principle of home rule in cities. In most states of the Union, if not in all, the discussion is largely academic, for there is no more real home rule in the average American city than a state legislature, proud of its power and anxious to exercise it, is willing to allow temporarily, and largely as a cat plays with a mouse. But the desire for home rule in cities is developing at the same time that the advantages of expert disinterested supervision of the operation of the public service industries is being demonstrated by such efficient bodies as the Wisconsin State Railroad Commission. It is therefore a timely question as to whether the one advance will conflict with the other.

Mr. Meyer's paper is not a direct attack upon this question, but is largely a demonstration of the overwhelming advantage of taking the supervision of the public service utility out of the hands of the ignorant, changing personnel of the ordinary city council and putting it into the hands of a few experts who spend all their time upon the many problems arising and so can give satisfaction to both server and served. He carries the question into the higher field of inter-state relations, and

shows that the problem is the same though the terms in which it is stated are somewhat different and the method of solution is materially different.

In the case of state public service commissions, the speaker showed that the real features of home rule were not interfered with by the state control of the operation of the utilities under their control. The Wisconsin law expressly gives to every city council the power to determine by contract or otherwise the quality and character of service, the terms and conditions of the company's occupation of public areas, the extension of service, etc., subject only to such review by the state commission as will insure that the ignorance of the city officials has not been taken advantage of by the expert knowledge and business ability of the managers of the company.

Mr. Meyer might well have emphasized the fact that the city is primarily a business corporation and not a political organization. It is organized to do for its citizens what they cannot do for themselves, or what the corporation can do for them better and cheaper than they can do for themselves.

The home rule principle applies to the determination by the citizens, directly or through their representatives, the mayor and councilmen, of what they desire to do. It is evident that temporary officials, such as councilmen, cannot be expert enough to control the public service corporations, whether under private or public ownership, and it is an open secret that they are seldom able to select expert officials to operate them under public ownership, nor to keep experts when they happen to find them. It will doubtless turn out to be true, especially in the smaller cities and towns, that even under a business administration, technical matters will be mismanaged because sufficient compensation cannot be paid to secure competent superintendents, or for other reasons. All these things point to the expert state commission as supervisor of the technical construction, operation and financial plans and methods, but at the same time the latter show themselves to be details of operation which are quite aside from the real "home rule" issue, and may be safely handed over to state commission supervision without loss of any privilege which the future application of the principle of municipal home rule may confer upon the municipality.

The reason for extending federal control over inter-state public service utilities is not the same in all respects and the reasoning concerning it must be different. Those who are interested in this phase of the subject are referred to Mr. Meyer's paper, which is published in *The American Political Science Review*, under the title "Central Utilities Commissions and Home Rule."

STANDARDIZING SPECIFICATIONS.

After some years the idea that standard specifications for various kinds of construction work can be formulated has become popular. For a long time about the only attempt at such a formulation was that of the water works associations regarding water pipe, but of late years the process has been extended to other materials and methods of construction, the most prominent development being the formation of an association for the sole purpose of standardizing paving specifications. Immediately preceding the formation of this association the American Society of Municipal Improvement appointed a committee on standard specifications, which has since become one of its standing committees and made a considerable contribution to the subject at the recent Grand Rapids convention of the society. The difference in the methods followed by the committees of the two organizations suggests a discussion of the principles on which such work should be based in order to secure the most satisfactory results, from which it is possible that criteria may be developed by which to measure the propriety of these methods.

A standard specification cannot be expected to cover all the peculiarities of local conditions and must omit such items as are strictly local in their bearing, as well as permit such modifications of the provisions actually adopted as local conditions demand.

Specifications are of two general classes, those regarding materials and

those regarding methods of preparing for and using the materials. The specifications regarding general matters are more strictly appurtenant to the contract for the work, although they usually touch the more strictly construction matters close enough to justify their incorporation in the specifications. Being largely matters of law and custom they depend for form and extent to a large degree upon the local municipal laws and ordinances, and so they have been very properly omitted from the discussion of standard specifications.

As regards materials the general specifications may well set standards for those to be used in the best forms of construction, which should be approached as nearly as possible in each locality, due attention being paid to the questions of cost and availability. It may be more eeconomical for a certain locality to use a poorer class of materials and make the necessary repairs and replacements than to use the best materials which, because of inaccessibility or other reason, are so expensive that their ultimate cost as well as the first cost are greater than for the more available materials. These matters cannot be determined by the standard specifications, and the lines laid down by them should not be held so tight in such localities as to defeat one of the real purposes of the specifications; viz., to produce a structure which shall be not alone the best and of the best materials, but the most economical as well. If the standard specifications for materials and methods of construction are followed, successful structures should be secured. If the terms are modified the structures will be less successful from the standpoint of excellence of construction, but may be more successful from the standpoint of economy. It seems to be generally accepted that a standard specification cannot take account of these modifications, which are sometimes so necessary, and so can include only such materials and processes as are known to produce good results when properly applied. The caution against excessive strictness in applying them in a particular case is all the latitude which can be admitted.

It happens that a single specification does not always include all the materials which are known to produce good structures. Thus there must be specifications for cast iron, steel, wood and other water pipes; vitrified pipe, concrete, brick and other sewers; materials for treating blocks for wood pavements; asphaltic cements; cement and bituminous fillers, etc. Evidently these specifications must be alternate since no one specification will cover all the various kinds of material for the same use. A specification which omits any material which can and does produce good results fails to be a complete standard to that extent and is in so far open to the accusation of favoritism of one sort or another. The problem before the committee on standard specifications is to provide ample specifications which will admit all the good materials at the same time that it excludes those which cannot produce good results, except in special cases of unusually favorable conditions. New materials are entering the field every year, which must be covered. Their promoters should not be too seriously offended if they are required to show their merits before they are admitted.

Methods and processes used in preparing materials for use come very naturally under the specifications for materials. Those for using the prepared materials are likely to be largely local and special in their nature. The former are included in many standard specifications, although there is a commendable tendency to make the specifications cover the results of the treatment of the materials rather than the methods. The latter are included where special care is required in their application.

The Association for Standardizing Paving Specifications and the American Society of Municipal Improvements are working along parallel lines with many persons, members of like committees in both organizations, so that they are approximating uniformity in their recommendations. Both of them have succeeded in adopting the larger part of their standards for various pavements, and it is probable that the former organization at its January meeting in New Orleans will complete its work upon the fundamentals

of the specifications and that the latter society will come to the same stage at its next convention.

This does not mean that the specifications can then be considered as crystallized and complete, ready for use for any considerable length of time. Few specifications are as stable as that for cast iron water pipe has become, for example, and some are as yet in the formative state so far as many of their details are concerned. Then there are the new materials and processes which are added each year. The American Society of Municipal Improvements provides for these unfinished matters and for the new materials by making its committee on standard specifications a standing committee which will present each year such reports from its sub-committees as are required to keep the specifications up to date.

The process by which these questions are formulated into specifications is of much importance and the following program is presented as one which should secure full consideration of all the component parts of any proposed specification from all points of view. It would seem to be one which will give ample opportunity for all interests to have full hearing and for the adoption of such new specifications and modifications of old ones as are shown to be good, and to safeguard sufficiently the admission of materials whose fitness for the use for which they are proposed has not been proved.

In the first place the general committee on standard specifications appointed by the president of the society is made up of five past presidents of the society, and is presumably composed of men fitted to act as a sort of bench of judges upon the specifications brought before them, having mature judgment and more or less thorough and detailed knowledge of all the subjects presented.

Sub-committees are appointed to give detailed consideration to each class of specifications. Each such committee should be composed of experts in the subject referred to them, the nucleus being members of the society but having authority to associate with them more or less closely any engineers, chemists or others expert in the same lines. Each sub-committee should take into consideration all matters in its line which are brought to its attention and should call for the information it may desire and from any available source. After such full and free discussion at meetings or by correspondence, the committee should formulate its report, covering such changes in or additions to the existing adopted standards as seem to it desirable.

The reports of the sub-committees are, according to program, to be presented on the day before the annual convention at a meeting of the general committee. At this meeting each proposed specification will be discussed by the sub-committee presenting it, by the general committee, and by members of other sub-committees and others interested who may be present. The specification as finally formulated by the sub-committee and approved by the general committee is then passed to the consideration of the society. In this way the society receives the work of the experts in each line of work for which specifications are presented as it is reviewed by the general committee.

The society as a whole then has an opportunity to discuss the specifications and to adopt them or return them for further consideration. According to a recent change in the constitution, persons not active members of the association cannot join in this discussion without the permission of the convention.

Persons having particular interest in any proposed specification thus have an opportunity to present their cases to the sub-committee during the year and a further opportunity to join in the discussion before the general committee and before the society, if members, or by special permission, if not, which permission would undoubtedly be given if entitled to consideration.

In this way the engineer, chemist or other expert in the employ of the city, the contractor, the seller of materials, or promoter of methods have the opportunity to present all sides of every case; and if a proper decision is not reached at any convention there is the opportunity to carry the matter through the next year's committee.

THE QUESTION DEPARTMENT

Small Sewage Disposal Plants.

Will you kindly let me know if you have published anything in book form relative to sewage plants for small isolated settlements on the sea coast? MARTIN BROWN. C. E.,
Northport, N. Y.

Such books as Starbuck's "Modern Plumbing Illustrated," ($4), and Raynes's "Domestic Sanitary Engineering and Plumbing," ($3) give instructions on this subject. Also Kinnicut, Winslow and Pratt's "Sewage Disposal," ($3), and Venable's "Methods and Devices for Bacterial Treatment of Sewage" ($3).

Disintegrator for Sewage Solids.

I should esteem it a favor would you publish the following question in your Question Department in order that we may get an answer through MUNICIPAL ENGINEERING:

Have you any knowledge of sewage being treated by a disintegrator for the purpose of breaking all pulverized excreta, paper, rags, etc., volume of sewage (of a weak character) approximately one million gallons daily. The sewerage scheme is established on the separate system, the method of disposal being direct discharge into the tidal estuary into a river, practically into an harbor. The fall ends at a depth of 53 feet below low water mark. J. S. P.,
Chief Health Officer of Tasmania.

Sewage Test with Methylene Blue.

Will you please send me full information on making tests of sewage with methylene blue, also state results that should be obtained I intend to take samples of raw sewage, septic sewage and filtered sewage.
T. P., Indiana, Pa.

The method of using the methylene blue test is described in Kinnicutt, Winslow and Pratt's "Sewage Disposal" ($3). In brief a small amount of methylene blue, dissolved in water, is added to the liquid to be tested, which is put in a tightly stoppered bottle, and the number of days required for the color to be discharged is noted. The time requred for decolorization is about twice as long at 70 degrees temperature as at 98 deg. F. If the color is not discharged in 14 days at 70 deg. F. the liquid may be considered as non-putrescible. Phelps has made a table showing the degree of putrescibility as dependent on the time required to discharge the color. If the reducing time is 20 days, the stability is 99 on a scale of 100; if 10 days, 90; if 7 days, 80; if 4 days, 60; if 3 days, 50; if 1 day, 21.

The test may be applied to the raw sewage, thoroughly mixed, to the effluents from the septic tanks and the filters or to any mixtures of the effluent with various proportions of the water in the stream into which the effluent is discharged.

Mr. Phelps's paper is published in the U. S. Geological Survey's "Water Supply Paper No. 229."

Can Supply Ruddle or Natural Chalk.

In your magazine of May, 1911, on p. 431, Question Department, I note an inquiry for "ruddle." I would like to hear from L. C. H. if he is still desirous of obtaining some of this material.
JNO. R. ROOT, Terre Haute, Ind.

How to Treat Over-Printed Blue Prints.

Will you please tell me what to use when blueprints are burned?
W. H R., Kelso, Wash.

Blueprints which are over-printed may be improved somewhat by washing them with a weak solution of soda, which can be washed off with clean water when the effect has been produced. Can our readers make any suggestions?

Map of Underground Structures.

As I am going to make a map of our city showing location of all underground structures, such as water mains and service connections, sewers and house connections, catch basins, culverts, etc., I would like to ask you what you would call it. Substructural Map of City of Waupaca?
C. W. NELSON, City Engineer,
Waupaca, Wis.

What have our readers to suggest? "Map of the Underground Structures in the Streets of Waupaca" is one title which suggests itself, the lines referred to being all of them in the streets and no substructures outside the streets being shown.

Who Has Authority to Expend City's Money?

What is your opinion concerning the following:

Where a certain improvement was asked of the council, such as building a tile ditch costing say $100, and the improvement was rejected by the council by a vote of 4 to 2. Afterwards the street and alley committee, conniving with the superintendent of streets, purchased the materials and constructed the ditch. Question: Can the street and alley committee authorize a piece of work constructed after the same has been rejected by council by a majority vote? In case council had not passed upon the improvement could street and alley committee authorize the work? What would be the status of the matter if after the work was completed, having previously rejected the improvement, the

council would approve and allow bills for material and work? If the council would approve and allow bills for material and work, would the mayor be justified in refusing to sign voucher or order for same upon the treasurer, assuming that council had previously rejected the improvement, and the street and alley committee had no authority to build said improvement?

B., Mayor, ————, Ill.

Except so far as the statutes restrict the action of the city councils in Illinois, those bodies control the expenditures of the city funds. The council probably has certain by-laws or ordinances defining the duties and the rights of the city officials under it and of the council committees. The council has the right under its rules of procedure to suspend, rescind or modify these regulations or ordinances but must follow its own rules in doing so and also the statutes of the state. If there are no such regulations or ordinances governing a particular case, it is under the control of the council, which can determine what shall be done and how.

The case mentioned seems to be one in which there is some question as to the propriety of the action of the council and of its committee and the city officials and as to the necessity of performing the work in question. There is not sufficient information on which an outsider can base an opinion.

The mayor in Illinois has some control of the situation through his veto and his connection with the public works department. In this case he must apparently determine whether the superintendent of streets overstepped the bounds of his authority in making the purchases and doing the work. This can perhaps be determined from the ordinances and the orders of the council governing that official. He must then determine whether the council committee on streets and alleys has overstepped the bounds of its authority. The form of rejection of the proposed improvement and the necessity of making it have some practical bearing upon the question as to whether the committee and the superintendent have disobeyed orders or have simply proceeded in a legitimate alternative way when the council refused to be responsible for the order to construct the work.

Whether the committee would have the right to order the improvement in absence of authorization by council is also largely a matter of the ordinance or by-law governing the committee. Frequently such committees are granted or tacitly permitted to order improvements costing not to exceed a certain amount which varies from a few dollars up to say $500, within the limits of the statutes. Common limits are $50 and $100 in small cities. One must be familiar with the ordinances of the city in question to give an answer applicable to it.

Approval by the committee of the bills for material and work would ordinarily be approval of the work and would indicate that the committee and superintendent had, in the opinion of the council, acted within their rights under the ordinances; provided, of course, that the approval had not been given through inadvertence or because of intentional or unintentional concealment of the facts in the case.

It would seem to be the mayor's duty, under the statement of facts in the last sentence of the question, to determine whether the council had been misled or had misled itself, and whether the appropriation was a proper one under the circumstances, and he could send the matter back to the council for more definite action by means of a veto. If the bill is just it could probably be collected by suit, notwithstanding the mayor's veto, but he has the right to demand that the council record its approval of the construction, if it has not already done so, and can enforce that demand by means of his veto.

Municipal Asphalt Plants.

Will you kindly furnish me with a list of cities and towns which are operating their own asphalt paving or repair plants?

G. D. Carr, Chicago, Ill.

A list of such plants will be found in Municipal Engineering, vol. xl, p. 217.

Specifications for Wood Block Paving.

Would you kindly inform us where we would be able to secure a copy of specifications of the American Society of Municipal Improvements for wood paving?

H. B. Lauderbaugh, Pittsburgh, Pa.

The American Society of Municipal Improvement has not yet adopted specifications for wooden block paving. The report of the sub-committee on this subject was printed in the proceedings for 1910, but unfortunately the edition of that volume is exhausted. The same report came up for consideration again this year, but was again postponed for further consideration.

Cities Using Reinforced Concrete Poles.

Will you please advise me if you know of any city using reinforced concrete poles for lighting service? Do you know of any objectionable feature that has developed by experience in use of same?

I. A. M., Texaxs City, Tex.

The North Park Commission in Chicago has installed a considerable number of electric light poles made of reinforced concrete. They are used by electric railroads in and about Richmond, Ind., Oklahoma City, Pittsburgh, Chicago and other places. Reinforced concrete telegraph poles have been used to some extent by the Pennsylvania railroad and elsewhere. The use of these poles is extending gradually in every direction.

The only question raised has been that of electrolysis, but no effect of that sort on poles has been reported. Moisture promotes electrolysis and poles do not retain moisture long, especially if care is taken to make the concrete as dense as possible.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Another Machine for Mixing Asphalt Pavements.

We note on page No. 211 of your Question Department an inquiry in reference to machine for mixing asphalt paving materials, and we note in your answer that no reference is made to Warren Brothers Company, although we manufacture more asphalt paving plants of all types than any one else in this country.

We are mailing you under separate cover copies of our catalogues of the regular types of asphalt paving plants and also our Portable Asphalt and Repair Plant, which is built particularly for the use in such cases as your inquirer describes.

H. W. Ash,
Boston, Mass.

A photograph of the latest Warren portable asphalt pavement mixer will be found on p. 361 of this number of Municipal Engineering.

Proposed Method of Treating Blocks for Wooden Pavements.

To the Editor of Municipal Engineering:

Sir—I offer the following suggestions for treatment of wood paving blocks in the interest of bettering conditions in regard to wooden block pavement.

First. Careful selection of well seasoned lumber, which we must all concede is very important.

Second. Method at the plant, of suitable vacuum and pressure, length of time requirements.

Third. A reduction in the number of pounds of creosote oil per cubic feet of timber, to say minimum of 12 pounds and maximum of 16 pounds.

Fourth. A commercial creosote oil of special grade, 1.04 to 1.07 as maximum; purely a distillate of tar without any attempt of adulteration by adding refined tar or petroleum residuum.

Fifth. A pressure which is sufficient to impregnate the blocks with this lighter gravity oil thoroughly.

Sixth. After the preservative has been forced into the blocks, then waterproof the blocks on all sides by a final dipping treatment into hot asphaltic cement of suitable penetration or consistency.

As creosote is a solvent for asphalt, the blocks should be permitted to dry somewhat before immersion in the hot asphaltic cement. By so doing the dead oil does not act upon the asphaltic cement to any great extent.

This waterproofing on all sides affords a barrier against absorption from and through the concrete base, also provides each block with a thin coating on the sides and ends for taking up any expansion which may be possible, although I believe this will be entirely eliminated. The top coating, after completion of the pavement, could be sanded slightly and the travel would mix this sand with the asphaltic cement and thus form a mastic. This coating would serve to protect as well as prevent slipping of vehicles. In time the coating of mastic would be worn off, and at various periods when needed another surface coating could be applied by brooming, squeegee and sand sprinkled on.

The preservative creosote oil will serve its purpose, viz: to prevent dry rot by its properties, the asphalt coating would seal against evaporation or leaking or being washed out, and prevent the blocks taking up moisture to cause trouble by swelling.

By using the lighter gravity oil we would secure better and more thorough penetration to preserve the wood, perhaps in less time and with less pressure. This would tend to reduce the cost for the oil, also for the treatment, and such saving could be put into the extra cost of the second handling, although such a process could be arranged so that the cost would not be much to give the blocks the waterproofing coating. The additional treatment would give a better block.

This treatment would prevent bleeding and avoid much of the slipperiness now experienced. The waterproofing mastic coat supplied would increase the life of the block against wear and brooming.

By some calculation of the cost of the waterproof coating supplied, also the cost of the handling, as against the high price of adulterated creosote oil as now used (which should be less), the reduction of the

pounds of oil from 20 to 12 or 16 would about equal this additional treatment in cost and would afford, I believe, a much better block. Especially would this be worth the while if it would solve the present difficulties and annoyances experienced from a bleeding pavement, a slippery surface and the evils connected with tracking into houses of the surplus tar on the surface.

H. C. INNES.
Consulting Pavement Engineer.
Cincinnati, O.

Concrete Pavement with Bituminous Wearing Surface.

Under the heading of Concrete Pavement with Bituminous Wearing Surface there appears in your magazine a letter calling attention to coated pavements laid at Ann Arbor during the last year or two.

I have personally experimented with coated pavements since the year 1906 of substantially the construction described in that letter. The great difficulty in constructing roadways with a coating of bitumen is the physical impossibility of making such coating unite with the comparatively smooth surface of the cement. After a great many attempts, but only partial success, it was found that the Portland cement had to be roughened or prepared by means of solvents so as to produce a surface receptive and retentive of the coating. Since then I have invented a great improvement on this construction by placing upon the concrete a bonding coat composed of neat Portland cement and a uniform sized stone, to which sometimes a small amount of sand can be added. This layer being firmly held to the foundation and in return firmly holding the bituminous cement which is subsequently poured into its pores, produces a surface particularly suitable for roadways of medium and light traffic. The weight and strain is taken up by the Portland cement and the mineral aggregate, while the resiliency is produced by the bituminous cement. For this reason the pavement is called Double Bond, or Bitucrete pavement.

While this pavement cannot be constructed at the cost mentioned in the letter you publish, its superiority and advantages more than over-balance the greater cost. A piece of the Bitucrete Double Bond pavement has just been laid at Morristown, N. J., where, during my presence, was hauled over the pavement a load of sixty-two tons in one single truck pulled by twenty-four horses, the pavement being then only about ten days old. It was not affected in the slightest degree nor was there a mark left after the load stood on the same spot for over half an hour.

The cut illustrates the laying of the pavement.

AUGUST E. SCHUTTE.
Boston, Mass.

LAYING BITUCRETE IN MORRISTOWN, N. J.

A Sanitary and Power Canal for Buffalo, N. Y.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The Chicago sanitary and ship canal has been cut through the divide between the watershed of the Great Lakes and that of the Mississippi Valley; it may well be called the greatest artificial waterway ever constructed; it is 32 miles long, 22 feet deep, and 160 feet wide, developing 40,000 horsepower, which is sold in Chicago at a reasonable price; it is in better condition hygienically than the ordinary river flowing through an inhabited country. It takes from Lake Michigan 10,000 cubic feet per second and 48 miles below there is no trace of Chicago sewage left.

At Buffalo sewage passes into Lake Erie and Niagara river, polluting the water supply of the city and of the whole Niagara frontier. Buffalo river and Smokes creek can be made to run backwards around the city, through Cheektowaga and on to Lake Ontario. There will be greater dilution than in Chicago and there is no reason why such

a canal should not be clear and odorless.

Where Buffalo river crosses the city line on the east, a private company, incorporated as the Erie & Ontario Sanitary Canal Company, proposes to excavate the canal deep enough and wide enough to stop the crest of the South Buffalo floods by carrying off the waters of Buffalo, Cayuga, Cazenovia and Smokes creeks, crossing under all the railroads that enter Buffalo from the east, and passing under the divide at Williamsville through a tunnel six miles long. After emerging from the tunnel beyond Williamsville, the open cutting will continue as far as the barge canal, where the sanitary canal will syphon under the barge canal, and where a lock will connect the two, so as to admit 2,000 ton barges through to Lake Erie. From the barge canal northerly, the sanitary canal will be built to Lake Ontario, but not navigable.

The flow of water backwards will protect drinking water from contamination and will provide drainage for all that great portion of Buffalo and West Seneca tributary to Buffalo river and Smokes creek, which includes such portions as now cannot be drained into any existing trunk sewer because of being too low to drain without pumping. The plan admits of great enlargement and all the Niagara frontier can be made to drain into this canal.

The government has already ordered Buffalo to abate the Albany street sewer outlet; The Tonawandas will be provided for by reversing the flow of Ellicott creek and running it into this canal.

222,000 cubic feet of water per second enter Niagara river, including the dirty water from Buffalo river and Smokes creek; the sanitary canal needs 6,000 cubic feet, or less than 3 per cent. In regard to lake levels, no such great amount of water need be taken as is taken from Lake Michigan for the Chicago drainage canal, and the 6,000 cubic feet per second will not be a menace to navigation or to the beauty of Niagara Falls.

There is a fall of 327 feet between Lakes Erie and Ontario, and this canal will be so located as to utilize 312 feet of the fall, and not waste any of the available power.

Modifications of present plans for preventing floods in South Buffalo and providing deep water for navigation in Buffalo river will be very slight, and no stoppage of those plans now under way will be necessary; this plan fits naturally into all other great plans for improvement projected by the City of Buffalo, by the state, and by the national government.

Many cities have been restrained from polluting streams, and Buffalo is as bad an offender as any; individuals and municipalities down the river are damaged, lives are endangered and fishing is destroyed.

For power purposes the 6,000 cubic feet of water will generate, under a 312 foot head, about 170,000 horsepower. The east end of Lake Erie and the Niagara river will be purified from sewage and storm waters, because all the small streams and the sewers of the Niagara frontier will be turned backwards away from the lake and river.

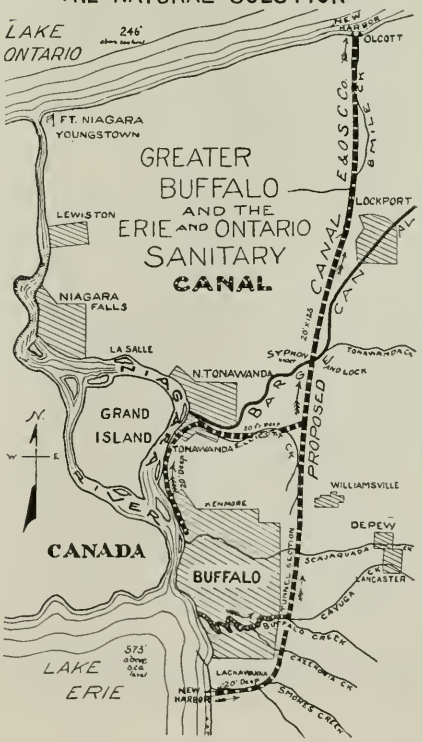
Although the canal will empty into Lake Ontario, the water will be purified before it reaches there; the scientific tests of the water of the Des Plaines river show that 48 miles from Lake Michigan there is no trace of Chicago sewage left.

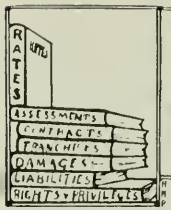
Sanitary authorities now agree that self-purification of slow running streams, if not too heavily charged with organic pollution, is thoroughly effective by means of sedimentation, bacterial action, insolation, and other biochemic processes; and in this canal the process will be the more thorough because of greater dilution than in the Chicago drainage canal.

The accompanying drawing shows the general location of the canal and the drainage and sewerage lines which it will intercept and turn from Lake Erie and the Niagara river.

Under the Canadian-American waterways treaty of May, 1910, an International Joint Commission has been formed to hear cases involving further withdrawal of water from Lake Erie or the Niagara river above the falls. This commission is now fully organized and the petition of the company for the award of the necessary water from the lake will soon be heard. J. W. H.

"THE NATURAL SOLUTION"





MUNICIPAL MATTERS IN COURT

Higher Courts.—Michigan Decisions on Bitulithic.

Decisions of the Higher Courts of Interest to Municipalities.

Advance Payment on Construction Contract Does Not Release Surety on Bond.—Where a contract to construct a sewer for a city, stipulating that each month the city's engineer should make an approximate estimate of the value of the work done, and that thereon payments should be made, provided that the engineer should be the referee to decide on the amount of work to be paid for under the contract, and that his estimates and decisions should be final and conclusive, his making in good faith too large an estimate for a certain month, in consequence of which the payment for that month was too large, but for which deductions were made in subsequent months, was binding on all parties, so that the payment thereon could not be considered an advance, with the effect of releasing the surety on the contractor's bond.—Town of Wakefield v. American Surety Co. (Mass.), 95 N. E. 350.

Idem.—The surety on a municipal contractor's bond securing payment of material men is not discharged from liability to them by premature payment to the contractor, after the material claims accrued.—Empire State Surety Co. v. City of Des Moines et al. (Ia.), 131 N. W. 870.

Attempt to Evade Constitutional Debt Limit Invalidated Laporte's Purchase of Water Works.—A city owning a water works plant, but at the time without a supply of water suitable for domestic use, and being unable because of the constitutional limitation on its indebtedness to build an extension to secure an adequate supply, passed an ordinance by which it granted to a water supply company organized for the purpose the right to lay pipes through the streets and public grounds to its reservoirs, and to build a pumping station on its water works site, and contracted to buy from the company for a term of years a stated number of gallons of water per month delivered in its reservoir, and also to purchase $30,000 worth of the company's stock. The company agreed to procure an adequate supply of pure water from a designated source outside of the city, purchase right of way, and construct works and pipe lines to bring the same to the city. After the passage of the ordinance suit was brought by taxpayers against the city, its officers and the water supply company to restrain the carrying out of the contract or the issuance of bonds by either party, but a preliminary injunction having been denied, the city issued and sold bonds for $30,000 and paid it for stock of the company, with which, together with the proceeds of bonds issued by the company, secured by mortgage on its property, the extension was made. The city then purchased for $10,000 the remaining stock of the company from the contractors to whom it had been issued, and who were also the incorporators of the company, and the city operated the entire plant. By final decree in the taxpayers' suit subsequently entered it was adjudged that the ordinance and contract of the city were ultra vires and void, as having been made pursuant to a fraudulent scheme devised by the city officers and contractors to evade the constitutional limitation upon the indebtedness of the city, and entirely by the city and from the proceeds of the bonds issued by the company, and the city was enjoined from making any further payments under the ordinance or upon the bonds of the water supply company. Held that, under the rule of lis pendens, such adjudication was binding on the mortgagees of the company, and was conclusive against their right to recover from the city on the bonds or to foreclose on the pumping works or pipes of the company which were located on city property or in its streets, and which constituted permanent improvements thereon made without right, but that the same adjudication determined that the city never acquired any right or title to the property of the company outside of its limits, legal or equitable, which was therefore subject to the mortgage.—City of Laporte, Ind., v. Northern Trust Co. et al., 187 Fed. 20.

Street Sewage from Water Appliances and Laundry is a Nuisance.—The maintenance of a private sewer from plaintiff's hotel to a public street, discharging into the street sewage from all the water appliances and laundry of the hotel, constituted a nuisance per se which was subject to abatement without without ordinance or adjudication either by the city authorities or by private individuals. Sullivan Realty and Improvement Co. v. Crockett et al, 138 S. W. 924.

Waterworks Must Meet Specifications.—An ordinance embracing an agreement between

the city and a water company provided for a certain test of the waterworks, and that if such test should be demanded by the city council, and it should be found that it could not be satisfactorily made owing to a deficiency in the water system, then the city should be free from obligation to pay hydrant rental from 10 days after date of such trial to such time as the test could be sufficiently made. *Held,* that, from 10 days after subjecting the system to such a test showing a deficiency therein, to meet the calls of the test, the city would be freed from the obligation of paying hydrant rental, and for the water company to recover such rental, it devolves upon it to show that the water system complied with the test; that being a condition precedent to recovery. Antigo Water Co. v. City of Antigo (Wis.), 128 N. W. 888.

City Not Liable for Water Supply.—Where a municipality maintains a public water system, it is acting as a governmental agency, and is therefore not liable for negligence in maintaining the water supply. Oakes Mfg. Co. v. City of New York (N. Y.), 125 N. Y. 1030.

What Determines the Lay Out of a Street. —The city of Boston took part of lands for a short parkway, to be controlled by the park commissioners, and made a settlement with the owner, by which the city agreed to construct a roadway and walk, to which he should have perpetual access, and to assume any assessment for betterments for the construction of the park on the land not taken. Subsequently the city street commissioners laid out a street several miles long, which, where the owner's land lay, was superimposed on the parkway, and no physical change was made therein. *Held,* not to preclude assessment for betterments on the owner's lands for the new street, which was a wholly new layout by the commissioners; to "lay out" meaning in this connection, to fix the termini and prescribe the boundaries of a highway, and establish it as a public easement of travel, by official act of the proper authorities. Leahy v. Charles et al Street Com'rs (Mass.), 95 N. E. 834.

Factors Which Determine the Right to Unmetered Water.—Water used in operating a cafe, billiard room, bar, barber shop, and garage in connection with apartment houses, is used for "business consumption," within New York City waterworks regulations, permitting a commissioner to require installation of meters. An owner of an apartment house, operating a cafe, etc., for the use of his tenants, in which meters are ordered by the water commissioner, cannot claim the right to frontage water rates as to consumption outside the cafe, etc., where the plant is not arranged for the separate service. The New York City ordinance fixing frontage water rates being limited to buildings at least five stories high, an owner of an apartment building exceeding that height is not entitled to such rate. Johnson-Kahn Co. v. Thompson et al (N. Y.), 130 N. Y. S. 216.

Two Michigan Decisions on Bitulithic Patents.

The vallidity of the Warren patents, covering the admixture of different sizes of stone with bitumen in the wearing surface of a street pavement, has again been before the courts in two recent cases in Michigan.

The questions raised in these latter cases seem to have turned upon the sizes, quantities and proportions of stone required to be used under the specifications. In the case against the city of Holland, Mich., after the issues were made up, counsel for defendants withdrew their appearance in the case and permitted a judgment *pro confesso* to be taken, upon which a perpetual injunction has been issued, enjoining the defendants from "directly or indirectly making, using, vending or selling to others to be used, said improvements and inventions as described and claimed in the fifth, sixth, ninth and eleventh claims of said Letters Patent, No. 727,505, or any material or substantial part thereof;" and expressly holding that "a pavement constructed under the specifications adopted by said city of Holland for the improvement of Central avenue, as set forth in the bill of complaint, would necessarily constitute an infringement of one or more of the claims of said patent."

In the case against the city of Grand Rapids, where the New York convention specifications were modified by reducing the specified maximum size and proportions of the mineral aggregate (the specifications requiring the use of no stone coarser than one-half inch), after hearing the case argued on the affidavits filed by both sides, the court entered an order in the case, in which it was provided that, if within ten days thereafter the defendants would give bond in a sum sufficient to cover the damages to be sustained by complainant in a given amount fixed by the court as liquidated damages, in the event it should finally be determined that the patent had in fact been infringed upon by the construction of the pavement as actually laid, the application for the injunction would be denied.

This order of the court further provided that, if the defendants failed to give the bond specified, the complainant, upon giving bond in an amount fixed by the court to cover the damages sustained by the defendant, in the event it should be finally determined that no infringement had in fact been made, a preliminary injunction should issue, as prayed for. The order also provided that the work, if done, should be completed in strict compliance with the specifications.

The defendants failed and refused to give the bond to prevent the issuance of an injunction. The complainant immediately filed the bond as prescribed by the court, and the preliminary injunction was issued as prayed for in the bill.

The Holland case is thus finally disposed of, while the execution of the work under the Grand Rapids specifications is enjoined.

FIRE AND WATER

Monrovia Municipal Water Plant—Wheeling Municipal Plants—Columbus Water Works Pawn Shop—New London Water Works.

Monrovia, Wis., Municipal Water Plant.

The annual report of M. T. Gettings, superintendent of the Monroe, Wis., municipal water works plant, indcates a net revenue of $1,428 for the year. A total of 86,000,000 gallons of water was pumped and 800 tons of coal were burned. The total revenue of the plant was $17,260.

Municipal Ownership in Wheeling, W. Va.

In Wheeling, W. Va., the city water system is owned by the city, and the same is true of the electric street lighting plant and artificial gas plant.

The water supply of Wheeling comes from the Ohio river, from which it is pumped to a large reservoir on the top of Wheeling Hill, and is distributed from that point over the city to a portion of the suburbs. A new pump is being installed at the pumping station having a capacity of twenty million gallons a day.

The flaw in the water supply of the city is the condition of the river, which, at some seasons of the year, is such as to affect the purity of the water.

A movement is now on foot to install a filtration plant in the river at a point just above the water works. It is probable that the question of a bond issue for this purpose will be submitted to the people in the near future.

Wheeling is plentifully supplied with natural gas by private corporations and with artificial gas by the municipality. The artificial system has been the cause of much controversy during the past few years, but a solution is now in sight. A plant for the manufacture of water gas is now in course of construction and will supply it at a very moderate cost. The fight for the retension of this property was long and bitter but successful.

The city manufactures power for its street lights in a well equipped electric plant. A proposition to furnish lights has been made by a private corporation, but refused.

In 1908, a bond issue was passed to provide for certain improvements advocated by the city government. A number of these have been completed and the others are now nearing completion. Among the more notable are the water works improvements, costing $350,000; the new gas works, costing $110,000; street improvements to the value of $150,000; the new Market street bridge, erected at the cost of $55,000; the new incinerator, at a cost of $35,000, and the Caldwell's run improvements at a cost of $25,000.

A Municipal Pawn Shop Proposed to Loan Columbus, O., Water Works Deposits.

If the plan of the city officials develops Columbus, Ohio, will soon have a municipal pawn shop. It is planned to operate the pawn shop in connection with the waterworks department, which is also owned by the city, and the deposit funds of the water works department, which are required of customers, will provide the capital to be loaned out. Opposition to the ordinance which was adopted by council recently came from the fact that no money was in the city treasury or would accrue there under the Smith one per cent. tax law, which could be used for loaning purposes. Councilmen declare they have reached a solution of the problem by combining it with the waterworks office, and another ordinance with these provisions will be introduced in council. The clerks of the waterworks department will also look after the pawn shop, thus doing away with the necessity for additional clerks.

The Water Works System of New London, O.

The question of installing a water works system in New London, O., was agitated in 1904. The council reported in favor of the Bonney Creek impounding reservoir as a source of water supply, and submitted plans, specifications and estimates which involved the expenditure of $60,000.

About two years ago the subject was

again brought to the attention of the council and J. F. Cole of South Bend, Ind., submitted plans providing for a water supply from wells using a compression storage tank system, involving an expenditure of between $30,000 and $35,000. According to the village tax duplicate at the time this would be too large a bond issue to be secured by a vote of the people.

A supply of water was developed by drilling two wells about 100 feet apart which are said to furnish approximately one hundred and seventy gallons per minute. The water has been pronounced entirely satisfactory by the State Board of Health.

In the meantime the Ohio Legislature passed the Crosser I. & R. act, providing for the submission of ordinances of the kind necessary to adopt the "franchise and lease plan" to be submitted to a vote of the people at the regular election, if ordered by petition of the electors.

The New London Water Company having been duly organized, the council met on September 30th and passed Ordinances Nos. 427 and 428 by the unanimous affirmative vote of the six members thereof. The referendum election was then ordered by petition of the electors and notice of such election has been given to take place at the regular November election. Both ordinances must be approved to insure the installing of the plant.

Ordinance No. 427 grants a franchise to the New London Water Company in language which is similar to all such franchises granted to private water companies in this state, and will be approved by the Public Utilities Commission. Section 8 fixes a price of $45 per year as rental for each fire hydrant, which is somewhat lower than the price paid by towns taking water for fires and flushing purposes from private companies. The plant is to be leased by the village and this hydrant rental, which is enough to pay 4½ per cent. interest on $33,000 and to set aside over 1 per cent. of that amount as a sinking fund, is intended to be paid by the council into a fund to be applied on the rental of the plant, and as provided in Section 15, on the purchase price of the plant; and the final purchase may be consummated at any time during the life of the franchise. by issuing the 4½ per cent long time bonds of the village for the unpaid amount.

Ordinance No. 428 authorizes and directs the mayor and clerk to enter into a ten years' contract of lease for the water works system, and stipulates the amount of rental to be paid. The village is to pay $2,000 when the water works system is completed and accepted, and $3,100 annually thereafter for ten years. All over 6 per cent. interest so paid applies on the purchase price as provided in ordinance No. 427.

A bill recently passed by the Ohio Assembly provides that bonds may now be issued by villages for the purchase of self-supporting water works, which need not be considered when figuring the bond limit.

Taking into consideration the fire hydrant rental, the plant is expected to be self-supporting within twenty months after commencing operations. The cost of operation will be low, and experience shows that water takers usually number as many as electric light users in towns the size of New London. There are over three hundred and fifty consumers of electric light and power current here.

If these ordinances are approved by the people, The National Company, which is promoting the plan, expects to begin work in November so that the business portion of the village may be assured of adequate fire protection soon after Jan. 1, 1911.

The plans as finally approved and adopted provide for the laying of 2950 feet of 8-inch pipe, 4800 feet of 6-inch pipe, and 12,480 feet of 4-inch pipe, and the setting of 40 hydrants and 18 valves. Along paved streets the fire line will be laid between curb and sidewalks on one side of such streets, and two-inch service pipes will be lriven under the street every few hundred feet to furnish water to patrons on the opposite side. Paved streets, therefore, will not be torn up longitudinally, but only in crossing them at several places on one side of street intersections.

A special electric power line will be run from the present municipal electric light and power plant to the land where the wells are located. Isolated pump houses of brick will be located at each well, each furnished with one upright deep well pump, with 10 h. p. 110 v., d. c. motor with pressure type auto starter and the necessary pipes and discharge fittings.

The central station building will be of brick, 24x60x11 feet, and will be furnished with two 9x38 feet compression storage tanks, built of specially rolled steel of 60,000 lbs. tensile strength tested under air pressure of 100 lbs. to the square inch and made perfectly tight—guaranteed to stand a working pressure of 65 lbs. to the square inch, which is equivalent to a head of 150 ft., together with the necessary pressure and water gauges and special fittings and connections. Another set of tanks may be easily added when deemed advisable. In the open part of the central station will be located one 8x8 double acting air compressor with a 10 h. p. motor and necessary pipe fittings, connected with the tanks to boost the air pressure. Here also will be set in place two 8x10 triplex pumps, each with a 20 h. p. motor for use in case of emergency or fire, connected with a 35,000 gallon capacity re-inforced concrete reservoir or cistern, size 20x15 feet, with walls 10 feet below the surface, this cistern to be roofed.

ROADS AND PAVEMENTS

National Road Improvements—Injury to Streets—Progress in Good Roads.

National Road Improvements in Eastern Pennsylvania.

A movement has been instituted by the West Alexander (Pa.) Board of Trade to secure the improvement of the National road through West Alexander. State Highway Commissioner E. M. Bigelow, of Pittsburg, and other prominent officials looked over the situation that plans might later be made for the paving. Recently the state of Pennsylvania appropriated $350,000 for the improvement of the National pike, through the counties of Washington, Fayette and Sommerset, and it was the original intention of the commissioners of Washington county to start at the state line and macadamize the thoroughfare to a point beyond the limits of West Alexander. It was planned to make this stretch of road equal to the Flynn road.

The Board of Trade has taken up the matter of paving, instead of macadamizing the road, with the officials in charge and it is likely the concession will be granted.

Movement to Prevent Injury to Streets.

As a result of the tearing up of Scotland road by the Public Service Electric Company soon after it had been resurfaced and a request from the New York and New Jersey Telephone Company to tear up Charleton avenue, which also has been resurfaced, Chairman Frederick J. Lovatt, of the South Orange, N. J., street committee, secured the adoption of a resolution by the South Orange Village Board of Trustees that in the future any company which desires to tear up any road in the village must give six months' notice.

Recent Progress in the Good Roads Cause.

The holding of the convention of the American Association for Highway Improvement suggests a summary of recent progress in the field it covers, and MUNICIPAL ENGINEERING has expended considerable time, energy and money in making a collection of information sufficient to show how remarkable recent progress has been and how it has opened the way for still more rapid progress in the immediate future.

The brief state histories, which follow, give no idea of the time and effort necessary to secure the passage of the first road laws, but they show clearly the rapid increase in the interest in good roads, the progressive increase in appropriations, the improvements in methods and results which follow as soon as the law has had an opportunity to demonstrate its value. State aid has fully demonstrated its value in every state in which it has been tried; and the success in the states first adopting it, such as New Jersey, Connecticut, Massachusetts, New York, Maine, etc., has resulted in a large number of adoptions of the plan within the last two or three years. These are already demonstrating in their turn the value of the state aid plan; and as soon as they in their turn get their organizations in good running order there will be another rapid advance in the mileage of good roads put under construction. It is not necessary to point out these states. The following abstracts of the data gathered will show which they are, and make it possible to compare the general methods and results in all the states.

Acknowledgments are due to the U. S. Office of Public Roads, the American Association for Highway Improvement, the state road officials and many county road officials for information furnished. No such collection and comparison has yet been made as is here presented; and the only regret is that the data are so full that they must be made into a continued story. As much as possible is crowded into this number; and the data from the states farther down the alphabetical list will appear in subsequent numbers of MUNICIPAL ENGINEERING.

Attention is called to the valuable articles on roads and pavements in this number. It is a special number prepared for the Richmond convention; but the good roads movement is now so widespread and is advancing so rapidly that information about it will be given as fully as possible in each monthly number of this magazine. Several excellent articles on road materials and methods of construction have been crowded over into next month, and others are definitely promised for early publication. As usual, MUNICI-

PAL ENGEERING will do its utmost to keep in the front of the procession.

The following concerning the road work in the states, which are treated in alphabetical order, will be found of great interest, and presents much that has never been presented in as definitely comparable form in print.

ALABAMA.

The first state highway laws in Alabama went into effect April 5, 1911, so that they are not yet in full operation. The state highway commission consists of Robert E. Spragins, Huntsville, chairman; John Craft, Mobile; V. B. Atkins, Selma; Dr. E. A. Smith, University, and Prof. G. N. Mitcham, Auburn. W. S. Keller, Montgomery, is the State Highway Engineer. The first detail of the duties of the state highway engineer is the preparation of a map of the roads of the state and the designation of those which should belong to a system of trunk line or state roads, to be submitted to the legislature. He is instructed to establish standards of construction and maintenance, to advise local road officials, and have supervision of roads constructed under the act.

The first appropriation is of $154,000 a year from the convict fund, and limits the commission's expenses to $10,000 a year with authority to the governor to increase to $20,000. The remainder is apportioned equally among the counties and the governor may increase the apportionment to $4,000 a year per county if the funds permit for each county that appropriates a like amount for use on its roads. The regulation of the expenditure is in the hands of the highway commission and on roads costing more than $3,000 is in direct charge of the state highway engineer. Money not used within two years reverts to the state treasury. Repair of state roads is prescribed.

The department has issued bulletin No. 1 containing the law and is now issuing No. 2 containing articles on construction and maintenance of highways.

Of the 67 counties of the state 37 have applied for state aid and some construction is already under way.

The local roads are in charge of the court of county commissioners which includes the judge of the probate court and four commissioners, who appoint a supervisor of public roads. Counties are divided into precincts, with an apportioner and an overseer for each precinct. Convicts are employed in work on roads.

As an example of the awakening activity in the state Calhoun county may be cited, as setting an election in November on the issue of $350,000 bonds for construction of several trunk lines across the county. A half-mile of macadam road was built under the direction of the U. S. Office of Public Roads in Calhoun county which cost about $5,700 a mile, so that the county has a short example of what it is proposing to vote upon.

Improvements have been made on 6.59 per cent. of the toal mileage of roads. Alabama has a population of 2,138,093, is increasing at a rate over 15 per cent. per decade and its 67 counties range in population from 13,000 to 226,000.

ALASKA.

Alaska has a board of road commissioners which expended $260,000 in 1910 on 1843 miles of roads, winter and summer trails.

Up to June 20, 1909, there had been constructed or improved in all, 165 miles of wagon roads, 383 miles of sled roads and 241 miles of trail at a cost of about $690,000 obtained in part from U. S. appropriations and in part from "the Alaska fund."

Alaska has a population of 64,356 and its four districts range in population from 12,000 to 20,000.

ARIZONA.

The territorial engineer of Arizona, J. E. Girand, Phoenix, expended $200,000 in 1910 in constructing bridges, locating and grading roads. The original law regarding state roads was passed in 1909.

The tax levy for 1911 is 25 cents per $100 valuation in counties covered by the proposed system of highways and 5 cents in others.

Local roads are in charge of county boards of supervisors of three members each, who appoint a county superintendent of roads, and of trustees, three elected in each district in the ecounty.

Arizona has a population of 204,354 and is increasing over 65 per cent. per decade. Its 13 counties range in population from 4,000 to 35,000.

ARKANSAS.

Arkansas has no state road organization. Local work is in charge of the county court, county judge and at least two justices of the peace for each township, who appoint a county road commissioner. A road overseer is elected in each township. Convict labor is employed on the roads. Improvements have been made on 2.97 per cent. of the roads of the state.

Arkansas has a population of 1,574,449 and is increasing 20 per cent. per decade. Its 75 counties range in population from 9,000 to 87,000.

CALIFORNIA.

The new California highway commission was organized very recently and consists of Burton A. Towne, chairman; Charles D. Blaney and N. D. Darlington. Austin B. Fletcher, Sacramento, is the highway engineer and Wilson R. Ellis is the secretary. The law authorizes the issue of $18,000,000 bonds of which the first installment of $400,000 is now on the market. This sum

is to be expended in constructing and maintaining a system of state highways. For the years 1911-12 and 1912-13 the appropriations are $133,000 each. The counties are required to pay interest at 4 per cent upon all money spent in the county until the bonds are retired as provided.

From 1907 to 1911 the state roads were in charge of the state engineer and recent appropriations have been about $150,000 a year for construction, repair and maintenance of roads in mountainous districts, mainly, the total being $403,300. The last report of the state engineer on roads describes eight of these roads with a total length of about 300 miles, some of which are not yet finished. The same report shows that the taxes levied for road purposes in the various counties to be spent in 1910 amounted to $3,340,333.66. Prior to 1907 the state roads were under a state department of highways with a state commissioner in charge.

Under the laws for county and district construction of roads the local roads are in control of a board of five supervisors and a county surveyor. There is also a county board of forestry of five members. Each township or district has also a road commissioner.

Some counties have bonded themselves heavily for local construction of roads, notably San Diego, $1,250,000; Los Angeles, $3,500,000; San Joaquin, $1,890,000; Sacramento, $660,000.

Los Angeles county's plan includes 307 miles of road, of which there had been opened at the end of 1910 76.33 miles of oiled macadam and 14.25 of finished grading, bridges and tunnel, with 170.32 miles under contract or advertised for the letting of contracts. The liberal policy of the state and the opportunity for the application of equally liberal policies in the counties of the state are beginning to show their results; and California bids fair to be one of the most active states in road building, both state and local, for a number of years..

The use of oil upon highways has been developed to a large extent in California, and at least one-tenth of the 50,000 mileage of roads in the state is now oiled, or more thoroughly treated with oil during construction. The average cost of oiling is about 3½ cents a square yard, though some roads have cost double that amount.

Convict labor is employed in preparing road materials and in road building.

There are 48,069 miles of road in the state of which 8,588 have been improved.

California has a population of 2,377,549, is increasing in population about 60 per cent. per decade, and its 58 counties vary in population from 300 to 504,000.

COLORADO.

The highway work of Colorado has been in the hands of the state engineer since 1907, and some $125,000 for road construction and $50,000 for bridge construction were appropriated by the legislature for special roads and bridges and expended under his supervision. The legislature established a highway commission in 1910, of which W. N. Wiley, Denver, is state highway engineer, and J. E. Maloney, Denver, is secretary. The governor seems to have vetoed all appropriations made for the construction of roads and bridges, but $25,000 for the commission was approved. The attorney-general of the state has recently decided that the internal improvement and internal improvement income funds, amounting at the time of the decision to $232,678.83, are available for use and distribution to counties for road work. The commission, if it so desires, can distribute 90 per cent. of the funds to the counties and reserve 10 per cent. for equipment, repair and maintenance of roads under its own direction. None of this fund is as yet available. The state pays one-third the cost of state aid roads, the county two-thirds.

Local roads are in the hands of the board of county commissioners, 3 members each, who appoint a county superintendent of roads and divide the county into suitable township or road districts and appoint an overseer for each.

Some convicts are employed in crushing rock and they have been employed in constructing a few state roads. Colorado has a population of 799,024, which is increasing at almost 50 per cent. per decade, and its 60 counties range in population from 1,000 to 213,000

There are 29,693 miles of road in the state, of which 320 have been improved.

CONNECTICUT

The roads of Connecticut are supervised by the state highway commissioner, James H. MacDonald, Hartford. In case the board of selectmen of any town petition him successfully for the construction of a road he makes plans and receives bids and he and the selectmen all sign the contract. The selectmen may bid for the work on behalf of the town. If the property valuation in the town is more than $1,250,000, the state pays three-fourths the cost of construction, if less, the state pays seven-eighths, with a limit of $500,000 expenditure per year by the state on this account. The highway commissioner may build state roads as he may desire to the extent of $1,500,000 between 1907 and 1913. He keeps in repair all roads constructed under the law, not exceeding $50,000 from state funds. The limit of the fund for maintaining the highway commissioner's department is $65,000. The law applies only to main highways leading from one town to another.

The total expenditures on state aid and trunk line roads were $4,700,572, from 1895 to 1910, inclusive.

In 1907 a bond issue of $4,500,000 was authorized, to furnish funds for six years work under the new law of that year.

The appropriations made for 1907-8 were $999,868 by the state and $224,932 by the towns for general roads and $227,806 by the state and $55,805 by the towns for the trunk line roads.

For the years 1912 and 1913 the legislature has appropriated $2,000,000 for trunk line roads, $1,000,000 for other main roads, $200,000 for repairs, all of which are made by the state, and $220,000 for expenses of administration, making a total for the two years of $3,420,000

In 1907-8 92.75 miles of road were com- 146.59 miles under contract and not completed at the close of 1910. There are 12,583 miles of roads in the state, of which 3,031 have been improved, 801 of them in whole or in part by the state.

The change in methods of handling financial matters is shown by the change in the proportion paid by the state, from 1/3 to ¾ or ⅞; by the increase in allowable expenditure by towns from $3,000 a year in 1895 to $10,000 at present; by change from three commissioners in 1895 to one since 1897; by change from requiring towns to pay engineers' fees, advertisements and inspection by transferring these expenses to the state, inspection in 1899, and the others in 1903; by changing authority for receipt of bids and awarding of contracts from towns without restriction in 1895, to approval by the state commissioner in 1899, and to entire control by the state commissioner in 1907; by insertion in 1897 of provisions by which the state commissioner could let contracts amounting to less than $1,000 to the town itself without competition and by which the town could compete with other bidders on larger contracts; by change of the provision of 1895 whereby the selectmen chose the roads to be improved to that of 1901 giving the state commissioner a veto power, with the further provision of 1905 that the state commissioner could construct trunk lines without consulting town authorities, and finally to that of 1907 placing the full choice of roads to be improved with the state commissioner; by changing the obligation of 1895 of the towns to repair roads at their own expense, with the provision of 1901, without penalty, that the state commissioner could order repairs made by the towns, to that of 1905 appropriating $10,000 a year to loan money to towns to make repairs, and later to that of 1907 appropriating $25,000 a year and the proceeds of automobile licenses to pay three-fourths of the expense of repairs, and still later that of 1911 appropriating $200,000 a year and assuming for the state the whole burden of making repairs on state aid roads; the classifications of towns in 1899 so that towns of less than $1,000,000 (later $1,250,000) assessed valuation should receive greater proportion of state aid than those of higher value; the insertion in 1903 of the obligation to plant trees along all state road work as a part of the improvement; by the purchase of portable stone crushers under the law of 1903 for use of towns; the removal in 1907 of the time limit on appropriations so that one made to a town would remain in force until expended; the authorization of the $4,500,000 bond issue to cover six years' work; the increase of annual state appropriations from $75,000 in 1895 to $100,000 in 1897, $175,000 in 1899, $225,000 in 1901, $229,500 in 1905, $750,000 in 1907, $1,000,000 in 1909, and $1,710,000 in 1911.

The local control of roads is in the town boards of selectmen with membership of 3 to 7. There are also county commissioners, in boards of 3.

The reports of the highway commissioner of Connecticut give no detail as to expenditures, and it is difficult to ascertain even the totals of expeditures. Some figures as to cost of roads are available from other sources and indicate that macadam roads in Connecticut cost about $6,100 a mile or 67.5 cents a square yard; telford roads $8,000 a mile or 98.6 cents a square yard; gravel roads $3,700 a mile or 39.1 cents a square yard.

The population of Connecticut is 1,114,756, which is increasing over 20 per cent. per decade, and its 8 counties range in population from 26,000 to 337,000.

DELAWARE.

The roads of Delaware are under two state highway commissioners, one each for New Castle and Kent counties; viz., Francis A. Price, Wilmington and C. B. Hope, Dover, and one county engineer, Mr. Mustard of Georgetown, Sussex County. New Castle County is the only one showing activity in road construction, having built over 50 miles in 1909 and 1910, largely macadam, less than a half mile being bituminous macadam.

The original highway law was passed in 1903. The total expenditures on state-aid roads prior to 1911 were $177,871 and the appropriation for 1911 was $30,000. The state pays half the cost of state aid roads and the county pays half.

There are 3,000 miles of road in the state, of which 187 have been improved.

There are only two road supervisors for each district in Sussex Co., and one for each "hundred" in Kent Co.

Delaware has a population of 202,322, which is increasing less than 10 per cent. per decade, and its 3 counties range in population from 33,000 to 123,000.

DISTRICT OF COLUMBIA.

The roads of the District of Columbia are under C. B. Hunt, the engineer of highways of the city of Washington and may be considered largely as suburban streets.

The population of the District, mainly within the city of Washington, is 331,069 and it is increasing nearly 20 per cent. per decade.

FLORIDA.

There is no state supervision of roads in Florida. The roads are in charge of boards of county commissioners of five members, who appoint the county superintendent of

roads. Each county commissioner's district is a road district and there are three road commissioners for each district. An overseer is appointed for each sub-district. There is little activity in road construction except in the vicinity of Jacksonville and St. Augustine, where some paving is done, and along the selected lines of proposed national highways, where some sand-clay roads are being built. The macadam roads near Jacksonville have cost about $1 per lineal foot. The sand-clay roads cost from 10 to 50 cents per linear foot, 14 to 16 feet wide and 7½ to 9 inches thick. Pine-straw, so-called, is a surfacing used in some counties at a cost of $50 a year, renewals being made once a year or oftener as the slight traffic requires. Good roads meetings are being held to develop interest in permanent improvements. It is reported that 10 per cent. of the road mileage in the state has received some sort of improvement.

The law gives authority for working part of the state's convicts on the roads but this has not yet been done.

Florida has a population of 752,619, which is increasing over 40 per cent. per decade, and its 47 counties range in population from 4,000 to 78,000.

GEORGIA.

The State Geologist is the state official having road matters in charge. Construction is in the hands of the "ordinary" and the commissioners of roads and revenues, and a county engineer. An overseer is appointed for each road district into which a county is divided. Most of the work on roads is done by the county's convicts. Many miles of sand-clay roads have been built and many miles of roads are graded and drained where even the sand or clay for such roads is lacking Thus one county (Irwin) reports 30 miles of roads graded and drained in 1911 at a cost of $9,000, or $300 a mile. Assessments of $39,000 have been made on property benefited by such construction on the 100 miles of opened road in the same county. The average cost of building roads in the state is reported as $1,639 per mile for macadam, $1,200 for gravel, and $426 for sand-clay roads. Both state and county convicts are used in road construction under the law of 1908.

There are 82,232 miles of road in the state, of which 5,978 have been improved.

Georgia has a population of 2,609,121, which is increasing nearly 20 per cent. per decade, and its 146 counties range in population from 3,000 to 178,000.

HAWAII.

The belt road commission has a plan for a road around the island of Oahu for which the legislature has appropriated $200,000 of the $250,000 required for its completion.

The territory of Hawaii has a population of 191,909, which is increasing nearly 25 per cent. per decade. The population of the island counties varies from 800 to 82,000.

IDAHO.

A. E. Robinson, Boise, state engineer of Idaho, reports but one state road, which was built in 1911, is of macadam, somewhat over 3 miles long, and has cost the state $20,000. The appropriation for 1911 was $53,000. The original road law was passed in 1905, and a more complete law, passed in 1909, was declared unconstitutional. The state pays the full cost of state roads. Local roads are in charge of boards of county commissioners of three members each. They divide the counties into road districts in each of which a road overseer is elected annually by the people.

There are 18,403 miles of road in the state, of which 510 have been improved.

Idaho has a population of 325,594, which is increasing over 100 per cent. per decade, and its 23 counties range in population from 3,000 to 29,000.

ILLINOIS.

Illinois since the law of 1903, has had a state highway commission, now composed of Pres. Edmund J. James, chairman, Urbana; Joseph R. Fulkerson, Jerseyville; and LaFayette Funk, Shirley, with A. N. Johnson, Springfield, as state highway engineer. The commission has advisory powers only and has been doing some experimental work.

Under one act of the legislature the state penitentiaries have furnished since 1906 some 376,688 cubic yards of broken stone, which has surfaced some 380 miles of road. This is distributed approximately 25 miles in 1906, 45 miles in 1907, 75 miles in 1908, 80 miles in 1909, and 155 miles in 1910 and 1911. The department supplied in 1911 plans, advice and inspection for 20 steel bridges and 200 reinforced concrete bridges, as well as for the road construction. The department has also supervised during the year the construction of 20 miles of bituminous macadam, using different materials on each mile and 10 miles of ordinary macadam, using both the stone from the convict labor and stone furnished by local authorities.

The state has 94,141 miles of roads in use, of which 8,914 miles have been graveled or macadamized, including a few miles of bituminous macadam and brick roads and the 20 miles of bituminous macadam cited above.

The annual road and bridge taxes in the counties of the state increased from 4,000,000 in 1905 to $5,250,000 in 1909, to which should be added estimated amounts of $250,000 for county aid, $300,000 for hard road taxes and the estimated value of the labor tax, over $400,000, making the total annual local expenditures for constructing and maintaining roads some $6,200,000 in 1909, with a tendency to increase about $500,000 a year. In the 5 years, 1905 to 1909, the hard road taxes amounted to $1,533,582, averaging the $300,000 per year given above. The total expenditures on state aid roads prior to 1911 were $280,000, and the appropriation for 1911 was $65,000.

The department made a careful study of the traffic on country roads in 1906-7, on which a full report has been published.

The state has a road drag law whereby contracts may be made, preferably with adjoining landowners, to use the road drag at rates not exceeding $1 a mile each dragging in 4 winter months and 75 cents in the other 8 months, April to November inclusive. But little has been done by commissioners under this law. Illinois is laboring under the difficulties of little material for making good roads, an unfortunate advocacy by some prominent engineers of dirt roads and a neglect by the local commissioners of even the means recommended for making dirt roads better.

In counties not under township organization the local roads are in the hands of boards of three commissioners of highways and a district clerk as treasurer. The county is divided into these districts by the board of county commissioners. The boards of highway commissioners and overseers are appointed for each road district. Counties under the township organization have a county board of supervisors composed of the township supervisors. Each township has 3 township commissioners of highways who appoint an overseer for each district in the township.

Ordinary macadam roads are expensive in this state, say $7,100 a mile.

INDIANA.

The roads in Indiana are in charge of boards of county commissioners of 3 members each and of the township trustees, one in each township. Each township is divided into road districts with a road supervisor for each district having particularly in charge the working out of labor taxes on the roads. All of these officers are elected by the people and, notwithstanding the mixture of independence and supervision, some good results are obtained and many miles of improved roads are built each year. The county surveyor usually has charge of the engineering of the roads.

Of the total mileage of roads in the state 19,951 miles had been improved with gravel in 1904 at an average cost of $1,472 a mile, and 5,172 miles of broken stone roads at an average cost of $2,210 a mile At the same time the average cost per year for repairs was stated to be $88 for gravel roads and $48 for macadam roads.

No such complete statistics have been collected since that date, but the following comparison of certain counties for which data for 1904 and 1911 are at hand will give an idea of the extension of improvements during the 7 years:

COUNTY	Roads Built Prior to 1904.		Roads Built Prior to 1911.		Roads Built in 1911.		Cost of Roads Per Mile in 1904.		Cost of Roads Per Mile in 1911.		Miles of Road in County
	Maca.	Grav.	Maca.	Grav.	Maca.	Grav.	Maca.	Gravel.	Maca.	Gravel.	
Adams	115	102	...	...	25.	...	$3,200	$2,000	$3,000	$	525
Clay*	32	186	5	306	0.5	14	2,500	2,000	5,000	3,590	...
Grant*	...	460	...	600	15.5	6	....	2,000	3,616	2,333	....
Hancock*	...	402	40	635	...	2	....	900	....	2,000	980
Knox	64	200	105	320	5.	10	2,000	1,800	2,600	3,500	....
LaGrange	...	275	...	150	...	10	....	750	....	....	....
Madison*	...	325	15	740	5.	60	....	3,500	....	....	810
Orange	128	40	230	20	15.		1,800	1,250	2,000	....	450
Posey	65	31	78	111	10.		3,785	2,456	3,000	....	1,000
Pulaski*	13	67	23	171	.0	18	2,600	1,383	....	1,667	....
Spencer	29	...	29	...	3.	...	2,000	....	3,000	....	1,500
Sullivan	60	272	...	...	21.	11	3,200	2,600	3,300	4,330	400
Union	...	251	5	200	5.	...	....	600	4,952	...	240
Vigo*	...	220	22	309	7.7	17	....	1,414	2,520	3,476	739

*Clay county built 2 miles of road treated with Tarvia X in 1911, at a cost of $9,110 a mile.

Grant county's macadam roads are included in the gravel roads.

Hancock county has also 5 miles of brick roads and 300 miles of roads which have not yet been surfaced.

Madison county has 4 miles of bituminous macadam, 2 miles built in 1911 at a cost of $7,500 a mile and has 5 miles of brick road, two built in 1911. About 25 miles of macadam and gravel roads will be built in 1912.

Pulaski county has about 50 miles of road under contract, four miles of macadam and the rest of gravel. There are about 15 miles up for action by the board of county commissioners, estimated to cost $28,000.

Vigo county has 2.5 miles of road made of coal cinders and 1.25 miles of brick.

Illinois has a population of 5,638,591, which is increasing over 15 per cent. per decade, and the 102 counties range in population from 7,000 to 120,000, not including Cook county, containing Chicago.

If the other counties in the state have been as active as those given in the table the mileage of gravel roads is now some 27,000 or more and that of macadam over 5,800.

It is probable that this is an under estimate, as the rate of increase for 1911 is much greater than this would indicate.

The cost of building roads is still somewhat low in Indiana, although almost every county shows an increase in cost in 1911 from the average cost given for 1904.

Indiana has a population of 2,700,876, which is increasing less than 10 per cent. per decade, and its 92 counties range from 4,000 to 264,000 population.

IOWA.

The Iowa State Highway Commission, under the law, originally passed in 1904, is composed of professors in the state college at Ames, Prof. A. Marston, dean of the division of engineering being the head of the commission and T. K. MacDonald, Ames, the state highway engineer. The appropriations are about $10,000 a year for the organization expenses.

There are 102,428 miles of road in the state, of which 2,504 have been improved.

The use of the road drag has been pushed in this state and a fund is now provided which can be used only for this purpose. The law is mandatory, but, as in Illinois, is difficult of enforcement. The greatest development in the state has been in the construction of concrete culverts and bridges, many thousands having been constructed in the past seven years. An automobile license law is expected to raise funds for road and culvert improvement. River to river highways have been quickly put into condition for travel but not all put into permanent condition.

The local roads are in care of county boards of supervisors averaging 3 or 4 members each and boards of township trustees of three each, who appoint not more than 4 road superintendents and one or more overseers for their respective townships.

Iowa has a population of 2,224,771, which decreased slightly during the last census decade, and its 99 counties range in population from 8,000 to 110,000.

KANSAS.

Kansas has a state highway engineer, W. S. Gearhart, of the state agricultural college at Manhattan, Kan., but makes no appropriations for road improvements, the expense of the office, $6,500 for 1911, being taken from funds appropriated for the college. No report of mileage of improved roads is available although the average cost of construction per square yard is said to be 50 cents for macadam, 25 cents for gravel and 70 cents for bituminous surfaces.

Local roads are in the control of boards of county commissioners of 3 each and the boards of commissioners of highways of the townships, of 3 each, which appoint overseers.

Kansas has a population of 1,690,949, which is increasing about 15 per cent. per decade, and its 105 countes range in population from 1,000 to 100,000.

KENTUCKY.

The constitution of Kentucky has been amended so that the legislature can now provide for improved roads, but little advance has yet been made.

The local roads are paid for from the proceeds of county taxes. The general condition may be judged by a report from Bourbon county which states that there are 375 miles of road in the county of which 350 miles are broken stone macadam, 2 miles being constructed in 1911 at a cost of $1,750 a mile. The width of this road is 14 feet, and its thickness 10 inches in the middle and 8 inches at the sides. It is paid for from a turnpike tax of 25 cents per $100. Madison county has about 400 miles of road of which 350 miles are broken stone macadam. Three miles of road were graded and drained in 1911, no new turnpikes being built. The county spends about $30,000 a year on its roads and bridges, reconstructing 1 to 25 miles of old turnpike each year with machinery, and keeping up the other roads by contract at about $8 per rod for hard metal spread on the roads. Dirt roads are worked 0y the neighboring labor paid out of an appropriation of $10 a mile. Many metal culverts, one large and several small iron bridges were built in 1910 and 1911.

The local roads are in charge of the fiscal courts of the counties, consisting of the county judge and 3 to 8 justices of the peace, who appoint a supervisor in counties under tax systems, and a bridge commissioner. Each county is divided into road precincts also and an overseer is appointed for each precinct.

Kentucky has a population of 2,289,905, which is increasing a little over 5 per cent. a decade, and its 119 counties range in population from 4,000 to 263,000.

LOUISIANA.

The roads of Louisana are under the state board of engineers with G. Lombard, New Orleans, the acting state highway engineer. Little has yet been done in applying the law of 1910 providing that the state shall pay half the cost of new roads, under which the appropriation for 1911 was $132,355. The highway fund will receive also the surplus revenues of the oyster and the fish and game commissions. Convict labor is also used on the roads. It is reported that only 1.32 per cent. of the roads of the state have been improved.

The local boards are in the hands of the police juries of the parishes (counties) of 5 to 10 members each, who divide their parishes into districts and appoint an overseer for each.

Louisiana has a population of 1,656,388, which is increasing about 20 per cent. a decade, and its 60 parishes range in population from 4,000 to 340,000.

MAINE.

The roads in Maine are in charge of the commissioner of the state highway depart-

ment, Parker L. Hardison, Augusta. The original form of the present law was passed in 1901. As revised in 1907 and amended in 1909, it provides for the selection of a state road by the county commissioners in each county so desiring, to be followed by the selection of others consecutively as they are in turn completed; for a state highway commissioner, assistant and office force; for state aid for the selected state roads, $2 for each dollar appropriated by towns having valuation of $200,000 or less and for unincorporated township and progressively less amounts for richer towns to 75 cents for each dollar appropriated by a town of $1,600,000 valuation. The state commissioner supplies plans and specifications and inspects before accepting work. Towns may bid for work as other bidders do. State may appoint inspectors to be paid from joint fund for road. Maintenance of state roads must be by towns to satisfaction of state commissioner. The tax to provide funds for the state's share is ¾ mill per dollar. Funds not applied for by towns may be used by state in establishing trunk lines.

The expenditures for state aid roads under the law was $666,789 prior to 1911 and the appropriation for 1911 was $250,000. Trunk lines took $39,780 of state funds prior to 1911, also private subscriptions of $24,910.

There are 25,528 miles of road in the state, of which 2,703 have been improved, 641 of them under the state aid provision and 8 under the trunk line provision. In 1910 the state aid construction amounted to 8.14 miles macadam, 6.58 miles tar macadam, 87.3 miles gravel, 0.18 miles granite block, 22.93 miles dirt road, 125.13 miles in all.

The average cost of building roads is reported to be 64.6 cents a square yard for macadam, 37 cents for gravel and $1.07 for bituminous pavements.

The local town expenditures on road construction and maintenance are estimated at $1,377,000 a year. The local authorities are the boards of county commissioners, 3 each, and in the towns 3 to 7 selectmen and a town road commissioner.

Maine has a population of 742,371, which is increasing over 5 per cent. per decade, and its 16 counties range in population from 18,000 to 112,000.

MARYLAND.

By the law of 1910 the roads of Maryland are now in charge of the state roads commission, of which Walter W. Crosby, Johns Hopkins Univ., is chief engineer. The state road law was first enacted in 1898, and state aid was first granted by an act of 1904.

The total amount of state aid funds expended prior to 1911 was $1,431,103 and the amount expended for trunk line roads was $6,853,728. The appropriations for 1911 were $200,000 for state aid roads and $1,050,000 for trunk-line roads. The state pays half the cost of the state-aid roads.

Convict labor is employed in crushing stone.

There are 16,773 miles of road in the state, of which 2,142 have been improved, 183 under state aid and 145 trunk line roads. The average cost of roads is reported to be 90 cents per square yard for macadam, 47 cents for gravel and $1.12 for bituminous surface.

During the year 1909, the latest for which there is a full report, there were constructed under the law 106.7 miles of macadam roads, 4.58 miles of macadam with surfaces treated with asphaltic oils, 7.92 miles of gravel roads, 0.79 miles of marl, 2.84 miles sand-clay, 9.02 miles of shell roads, making a total of 131.85 miles. The construction in 1911 used the natural soil or earth, unscreened and screened gravel, oyster shell, broken stone, both limestone and trap rock, vitrified brick, sheet asphalt and stone blocks, but the mileage of each is not reported. Some 250,000 gallons of pitch were used in constructing about 30 miles of these roads. The surfaces of previously completed ordinary macadam roads were also treated with pitch compounds of various kinds to the extent of 500,000 gallons of the pitch.

The development of the road system of the state is shown by the following table kindly furnished by Major Crosby:

Year	State Aided Roads, Miles	Baltimore Washington Road, Miles	Baltimore Annapolis Road, Miles	State Road System, Miles	Totals, Miles
1906 ..	23.25	.....	.....	.....	23.25
1907 ..	51.81	.....	.....	.....	51.81
1909 ..	112.99	18.57	.....	0.	131.56
1910 ..	140.91	18.57	.....	53.68	213.16
1911 ..	166.49	18.57	3.02	171.95	360.03
1912* .	12.10	5.39	10.18	159.33	187.00

* These figures show the length of road of each class underway on the first of January, 1912, which, when completed, will be added to the totals of 1911 to give the total mileage in the state which will then be about 550 miles in the state. About half of the 187 miles has been completed but not yet accepted.

Half the cost of state-aided roads is paid by the state, and the whole cost of the others in the table.

The total cost of this work to June, 1910, with estimate of cost of completion of contracts to 1911, thus giving the cost of the mileage in 1910 in the above table, is shown by the following from the final report of the Highway Commission of the Maryland Geological Survey on turning the highway system over to the new State Roads Commission:

Expenditures for construction of state roads, services, etc., including administration.....	$ 506,342.04
Paid by state to counties for state aid roads.....	495,113.73
Paid by counties as their share of state aid roads.....	511,202.74
Coutracts outstanding.....	271,550.00
Total cost of roads paid for in part or whole by the state....	$1,784,208.47

Maintenance of the roads is in the hands of the county authorities.

The local roads are under the boards of county commissioners of 3 or more members

each, who appoint a county road engineer and supervisors for each township.

The population of Maryland is 1,295,346, which is increasing less than 10 per cent. per decade, and its 24 counties vary in population from 10,000 to 558,000.

MASSACHUSETTS.

The roads of Massachusetts are in charge of the state highway commission of 3 members, of which Harold Parker is chairman and Arthur A. Dean is chief engineer, with offices in Boston.

The present law is very nearly the same as the original act of 1893. It provides for advice to local road officers and for state aid upon petition of the local authorities. When a petition is accepted the state takes control of the entire road. The town can take the contract for construction under the state specifications and inspection, but if not the state lets the contract and puts a resident engineer in control of the work. The state pays the entire cost, but one-fourth the cost must be repaid to the state within 6 years by the county in which the road is located. The roads are maintained by the state, but the local authorities can make independently temporary repairs when in danger of damages from accident or otherwise, although responsibility for such damages is transferred to the state. The town or city can take the contract from the state for keeping its roads in repair. The cost of maintenance up to $50 a mile a year is paid by the city or town, cost beyond $50 is paid by the state. Under the "small town act," the state may expend in any town of less than $1,000,000 property valuation, 40 per cent. of its own average annual appropriations for road purposes, and may fix the minimum at $400 per year, if the appropriation, which is 10 per cent. of the total state appropriation, will allow. Larger towns may receive a portion of 5 per cent. of the total state appropriation in case they make special appropriations in addition to the regular sums used, equal to the sums apportioned from the state funds. The state purchases rollers, crushers, etc., and loans them to towns of less than 12,000 population in addition to their use on the state's own work. Thirty-year bonds are issued by the state to raise funds from which to make its appropriations. Maintenance appropriations are made annually from current revenues, since 1908, largely from motor vehicle licenses. Twenty per cent. of this license fund may be spent on local roads not yet under the state system.

Appropriations have been made as follows under the law:

CONSTRUCTION.

1894	$ 300,000
1895	400,000
1896	600,000
1897	800,000
1898	400,000
1899	500,000
1900	500,000
1901	500,000
1902	500,000
1903	*2,250,000
1907	*2,500,000
Total	$9,250,000

* Appropriations for 5 years, one-fifth to be spent each year, that for 1907 extending through 1912.

MAINTENANCE.

1903	$ 40,000.00
1904	50,000.00
1905	60,000.00
1906	*64,166.66
1907	100,000.00
1908	**232,628.00
1909	**410,000.00
1910	**530,672.22
Total	$1,487,466.88

* Appropriation for 11 months.

** Include amount available from motor vehicle fees fund.

Convict labor is employed in crushing rock and in road building.

There are 17,272 miles of road in the state, of which 1,073 have been improved under the state aid law.

Average cost per square yard of roads is reported to be as follows:

Gravel	4 in. thick, 11 cents
Gravel	5 in. thick, 14 cents
Macadam	
Local stone	4 in. thick, 39 cents
Local stone	5 in. thick, 50 cents
Trap rock	4 in. thick, 57 cents
Trap rock	5 in. thick, 74 cents
Bituminous	
Gravel	2 in. thick, 37 cents
Macadam	2 in. thick, 48 cents

Earlier reports of cost, averaging roads built from 1895 to 1907, show higher figures, the weighted average being $7,663 a mile of road or 91.6 cents a square yard with 6 inches depth at center and 4 inches on sides, principally trap rock and granite.

The rate at which roads are improved and the proportions of different kinds is indicated by the 1910 report, showing construction of 18 miles of macadam, 6.5 miles of macadam with asphaltic oil surfacing, 2.5 miles of macadam treated with tar by the penetration process, 14.75 miles of gravel treated likewise, 6 miles of gravel, 6.75 miles of sand and oil, a total of 54.5 miles. There were also 41 miles of small town road work done. Bituminous surfacing was applied to 219.3 miles of old roads.

The local roads are in the charge of boards of county commissioners of 3 members each, and of the town selectmen, 3 to 9 in number.

The population of Massachusetts is 3,366,416, which is increasing about 20 per cent. a year and its 14 counties range in population from 3,000 to 731,000.

MICHIGAN.

The Michigan road law was first passed in 1905 and has had some minor changes since. It provides for a state highway commissioner, the present incumbent being Townsend A. Ely, Lansing, with Frank F. Rogers as deputy. The county and township highway commissioners are required to attend an annual road institute and all of them as well as the road

district and the township overseers of roads may be required to made sworn annual reports answering questions of the state commissioner, under penalty for neglect. The highway commissioner disseminates information, provides outline plans and specifications and expert advice. Whenever a mile of road is improved under township or county authority, under plans asked from and furnished by the state commissioner, he allots funds from the state reward for roads at the rate of $250 to $1,000 a mile, according to the character of the road, as described in the law. Allotments are made in order of application as funds are available, not exceeding one mile a year in any one township and provided state reward roads already in use shall have been kept in repair.

The appropriations under the act have been $110,000 for 1909, $160,000 for 1910, $150,000 for 1911, of which $10,000 each year is for the expenses of the department. The total expended on state aid prior to 1911 was $510,000. This amounted to about 22.5 per cent. of the total cost of the roads built under state aid.

Convicts are employed in breaking stone and upon road work.

Of the 69,104 miles of road in the state 4,319 have been improved, 790 thereof with state aid.

In the year ending June 30, 1910, 199 miles were improved on which the state rewards amounted to $123,035. Applications for aid are more numerous than the appropriations can cover. In about a month in September and October, 1911, there were 165 applications for aid, aggregating nearly 175 miles.

The activities of counties may be estimated from the following county reports:

Genesee county had about 65 miles of gravel road and added 15 miles in 1911; 3¼ miles of macadam and added 6 miles in 1911 at an average cost of about $5,500 a mile, of which $1,000 was paid by the state and the remainder by the county. It is proposed to build about 10 miles of macadam road in 1912.

Grand Traverse county had 10 miles of gravel road in use and added 5 miles in 1911 at a cost of $3,000 a mile, of which the state paid $500 and the county the remainder. Under the county road law about $33,000 has been spent and $17,000 is asked for 1912.

Livingston county has about 1,000 miles of road. In 1911 there were improved 10.5 miles of road with gravel at a cost of $1,500 a mile, of which the state paid $500. These were built and paid for by the township commissioners. Nine townships in the county will build in 1912 from 1 to 3 miles of gravel road, aggregating 15.75 miles.

Wayne county built 28 miles of road in 1911, 21 of them being of concrete. The concrete roads cost $1.10 to $1.80 a square yard and roads are usually 15 feet wide. One road 3.236 miles long and 16 feet width, of concrete 7 inches thick and 4-foot gravel shoulders, cost $1.35 for roadway proper and $1.426 including grading, shoulders, etc. This is $13,426 a mile. The county has issued $2,000,000 bonds for building these roads.

The local roads are in charge of the board of county supervisors, one member from each township, except in counties adopting the county road system, which elect 3 road commissioners. The townships also have highway commissioners.

Michigan has a population of 2,810,173, which is increasing over 15 per cent a year, and its 83 counties range in population from 2,000 to 532,000.

MINNESOTA.

The state road law was established in 1905 and provided for state aid, one-third the cost of state aid roads being paid by the state and two-thirds by the county. Louis W. Hill, Minneapolis, is chairman of the state highway commission and George W. Cooley, Minneapolis, is secretary and state engineer.

The state funds are the proceeds of one-twentieth mill tax per dollar valuation and profits of internal improvement land fund.

The amount spent in aid of road building prior to 1911 was $280,940. The amount appropriated for 1911 was $19,300. The state has built about 10 miles of road in small sections at its own expense.

Convicts are used in crushing rock.

Of the 79,323 miles of road in the state 3,417 have been improved.

The cost of the roads built is reported to average 55 cents a square yard for macadam and 10 to 20 cents for gravel.

Activity varies greatly in various counties as may be seen from some sample reports.

In Jackson county state roads have been graded but not improved with macadam or gravel. No state aid was received in 1910 or 1911. The county appropriations of $9,835 were used in building bridges.

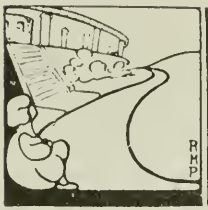
Lincoln county had 45 miles of graded roads to which 10 miles were added in 1911 at a cost of $500 a mile. Four miles of gravel road were built at a cost of $1,320 a mile. Almost $8,000 will be expended in road building in 1912.

Mahnomen county was organized in 1907, and is a wild prairie without improved roads. There are about 24 miles of state road, with 36 miles in prospect. Town roads measure probably 50 miles.

Renville county has 2,000 miles of road, of which 150 miles are of gravel and 2 miles of macadam. Reports for 1911 are not yet in.

Todd county has from 1,200 to 1,400 miles of road and macadamized one mile in 1911. The roads are nearly all built by the townships and poll taxes are worked out. Each of the 28 townships averages annual expenditures of $1,500 on roads.

The local roads are in charge of the board of county commissioners of 3 or 5 members and a county superintendent of highways, and of the town board of supervisors and a town road inspector.



ORGANIZATIONS & INDIVIDUALS

American Association for Highway Improvement—American Society of Municipal Improvement—American Road Builders Association—International Pure Water Association—International Fire Engineers—Technical Associations—Calendar of Technical Meetings—Technical Schools—Personal Notes.

Road Congress of the American Association for Highway Improvement at Richmond, Va.

Upon invitation of the mayor and the Chamber of Commerce of the city of Richmond, Commonwealth of Virginia, the first annual Road Congress of the American Association for Highway Improvement and its affiliated organizations will be held in that city, November 20-23, 1911.

The coming Road Congress will bring together the foremost engineers, road officials, traffic experts, legislators, railway officials, manufacturers, contractors, and agriculturists, who will devote their serious attention to the various and important problems of road construction, maintenance, and administration.

The purposes for which the American Association for Highway Improvement was formed and which may be said to represent the aims and purposes of the coming Road Congress are as follows:

To correlate and harmonize the efforts of all existing organizations working for road improvement; to arouse and stimulate sentiment for road improvement; to strive for wise, equitable and uniform road legislation in every state; to aid in bringing about efficient road administration in the states and their subdivisions, involving the introduction of skilled supervision and the elimination of politics from the management of the public roads; to seek continuous and systematic maintenance of all roads, the classification of all roads according to traffic requirements, payment of road taxes in cash, and adoption of the principle of State aid and State supervision; to advocate the correlation of all road construction so that the important roads of each county shall connect with those of the adjoining counties and the important roads of each State shall connect with those of adjoining States.

Honorary delegates to the Congress are the President of the United States, the Vice-President, the Speaker of the House of Representatives, the Cabinet, the United States Senate and House of Representatives, the Supreme Court, the representatives of foreign governments, the Governors of and Lieutenant-Governors of the States and Territories, the State highway officials, other state officials, the mayors of cities, the presidents of State and other universities and colleges, the officers and members of the American Association for Highway Improvement, the officers and members of the Touring C ub of America, the representatives of the press.

Official delegates are two state delegates from each Congressional district appointed by the governor of each state and territory, within which such district lies, three delegates appointed by the mayor of each city five delegates appointed by each national or interstate organization concerned directly or indirectly with road improvement, two delegates appointed by each state or other university or college and by each agricultural college or experimental station, three delegates from each state Association for Highway Improvement, three delegates appointed by each State Board of Trade and Chamber of Commerce, three degelates appointed by each Chamber of Commerce, Board of Trade, Commercial Club, and Business Men's Association directly concerned in the work of road improvement

Any one desiring to attend the Congress can doubtless secure appointment as an official delegate in one of the classes named.

The President of the United States will deliver the principal address on the opening day of the Congress which will be known as "National Day." Other distinguished men of achievement will deliver addresses on that day, among them, Governor Mann, of Virginia, Dr. Walter Page, Editor of the World's Work, W. W. Finley, President Southern Railway Company, Gen. T. Coleman DuPont, who is presenting to the State of Delaware a $2,000,000 boulevard, Hon. J. Hampton Moore, President, Atlantic Deep Waterways Association, and Hon. John H. Bankhead, of Alabama.

The second day of the Congress will be known as "Highway Engineers and Con-

tractors Day" and will be devoted to the practical problems of road construction and maintenance. Mr. Harold Parker, Chairman of the Massachusetts State Highway Commission, will preside. A number of the leading engineers and contractors of the United States and Canada will present twenty minute papers on the subjects with which they are most familiar. Among them will be: W. A. McLean, Provincial Engineer of Ontario, Canada; W. W. Crosby, State Highway Engineer of Maryland; A. N. Johnson, State Highway Engineer of Illinois; A. H. Blanchard, Professor of Highway Engineering, Columbia University; P. St. J. Wilson, State Highway Commissioner of Virginia, and John A. MacArthur of MacArthur Brothers, New York. These papers will be followed by five minute talks by other leading engineers and contractors and the proceedings will be published later on as bulletins of the American Association for Highway Improvement.

At 3 o'clock on "Highway Engineers and Contractors Day" the Manufacturers of road machinery, apparatus and materials will hold a meeting for the purpose of effecting a permanent organization to cooperate with the American Association for Highway Improvement and to promote in general the progress of road improvement in the United States. It is expected that from seventy-five to one hundred of the leading manufacturers will be represented and an interesting program will be given.

The third day of the Congress will be known as "Road Users Day" and will be conducted under the auspices of the Touring Club of America. It will be devoted to a discussion of the varioues problems of traffic regulation, not merely from the standpoint of the automobilist, but from every other standpoint. Hon. James S. Harlan, member of the Interstate Commerce Commission and a Director of the Association, will preside. The address of welcome will be delivered by Mr. Preston Belvin on behalf of the State Automobile Association and will be followed by J. T. Palmatary, President of the Richmond Automobile Club. Many distinguished speakers will present different phases of the traffic subject among whom will be: Senator Swanson of Virginia; Hugh Chalmers of Detroit, Col Charles Clifton of New York, Howard D. Hadley of New York, and many others of note. Moving pictures showing effects of good and bad roads will add to the humorous and dramatic interest of the day.

The fourth day of the Congress will be known as "Association Day" and will be devoted to the work of the American Association for Highway Improvement, the various affiliated organizations and the great National Associations indirectly concerned in the movement for road improvement. Dr. Joseph Hyde Pratt, State Geologist of North Carolina and President of the Southern Appalachian Good Roads Association, will preside. In addition to the affiliated organizations, it is expected that representatives of such important organizations as the National Grange, Farmers' Union, Automobile Associations, the National Civic Federation, Mothers Congress, the Lincoln Memorial Highway Association, and other organizations of similar standing will be heard on that day.

Tours of automobilists are beng arranged under the auspices of the Touring Club of America from all the principal cities of the country to the Road Congress.

The Capital Highway Association, under the able leadership of Leonard Tufts, is arranging tours over the Capital Highway route from Atlanta to Richmond. Mr. Tufts announces that cars will leave Atlanta in time to reach the Congress by November 19. The Association will hold its convention in the parlor of the Jefferson Hotel on the afternoon of the second day of the Congress, beginning at 3 o'clock.

Howard D. Hadley of Plattsburg, N. Y., and George A. Simard of Montreal, Canada, who are promoting a great highway from Quebec to Miami, Fla., will organize tours of automobilists from Quebec, Montreal and northern New York points who will meet at Richmond the tourists coming up from Miami and southern points, and it is hoped that this will be the occasion for taking such steps as will insure the completion of this great international highway.

The Congress of the United States has appropriated $2,000,000 for a memorial to Lincoln. The Lincoln Memorial Highway Association is seeking to have the memorial take the form of a great highway. Two routes are suggested for the highway, one from Washington to Gettysburg and one from Washington to Richmond. At Richmond the advocates of a Lincoln Memorial Highway will be heard and the Congress may be expected to make some definite action in regard to this important matter.

A more appropriate place than Richmond for the assembling of the first Good Roads Congress, under the auspices of the American Association for Highway Improvement, could not have been selected. The great undertaking of the Quebec-Miami Road, practically assured as far as Washington, D. C.; the project of the Capital Highway Association for a highway through the capitals of a number of Southern States, and the suggestion that the Lincoln Memorial, provided for by a Federal appropriation of $2,000,000 shall take the form of a national highway from Washington to Gettysburg, or from Washington to Richmond, pointed to Richmond as an eminently suitable forum for the discussion and exploitation of these several projects which may become object lessons in the construction of national highways.

Being conventinetly situated on the Atlantic seaboard to the middle west; the portal through which the people of the two great

eastern sections of this country, the North and the South, pass in their social and commercial relations; and the border city of the South, which, it is conceded, will be the scene of unsurpassed material development in the near future, presenting the greatest field for good roads improvement, Richmond logically offers the opportunity for successfully inaugurating the propaganda of the Highway Association.

Other considerations will render Richmond a convenient and attractive city to delegates and tourists.

Governor Mann of Virginia has issued a proclamation calling attention to the Road Congress and designating the week immediately preceding it as "Good Roads Week." He will urge in his proclamation that civic organizations, public schools, churches and all other influential agencies for the public welfare devote special attention to the subject of road improvement during that week.

Richmond is celebrated not only for its hospitality but for the incomparable manner in which this hospitality is extended to its guests. Preparations are beng made for a brilliant series of social events to occupy the evenings during the continuation of the Congress.

The official headquarters of the Road Congress will be at the Jefferson Hotel on Main, Franklin and Jefferson Streets, west. Delegates and visitors will find the registration room on the office floor of the hotel. The meetings of the Congress will be held at the auditorium of the Jefferson Hotel.

The Southern Railway, the Chesapeake & Ohio Railway, the Seaboard Air Line, the Atlantic Coast Line and the Richmond, Fredericksburg & Potomac Railroad enter Richmond. Arrangements are now under way to secure reduced round trip rates to Richmond. Delegates and visitors should consult their local or general passenger agents for details as to routing, rates, etc., or write to the office of the American Association for Highway Improvement at Washington.

Logan Waller Page, Director, U. S. Office of Public Roads, is President of the Association, W. C. Brown, President New York Central Lines, is Vice-President, Lee McClung, Treasurer of the United States, is Treasurer, J. E. Pennybacker, Jr., is Secretary, with offices in the Colorado Building, Washington, D. C.

The affiiliated organizations include the Ohio Good Roads Federation, Western Michigan Development Bureau, Gulf Coast Good Roads Association, Aroostook County Good Roads Associaion of Maine, Montana Society of Engineers, Arkansas Good Roads and Drainage Association, North Carolina Good Roads Association, Memphis-to-Bristol Highway Association, South Carolina Good Roads Association, International League for Highway Improvement, Good Roads Club of Georgia, New Santa Fe Trail Association, Indiana Association for Highway Improvement, Iowa Goods Roads Association, Southern Appalachian Good Roads Association, Central Highway Association, Capital Highway Association, Touring Club of America, Tennessee Association for Highway Improvement, Omaha-Denver Goods Roads Association, Inter-Mountain Goods Roads Association, Oregon Association for Highway Improvement, Southeastern Kentucky Good Roads Association, Knox County Good Roads Association, Washington-to-Bristol Highway Association, Mothers Congress, North Dakota Good Roads Association, Virginia Road Associations, Manufacturers Committee.

The principal hotels are the Davis, Jefferson, Lexington, Murphy's, Richmond, Stumpf's.

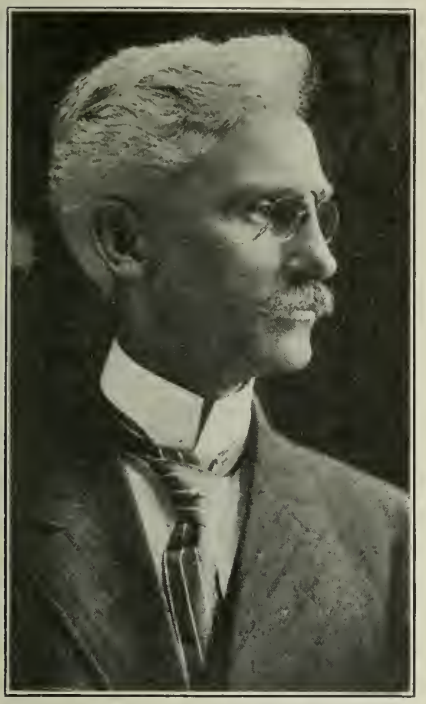
The Road Congress will open each day at 9.30 a. m. The afternoon sessions will begin at 3 o'clock.

American Society of Municipal Improvements.

The eighteenth convention of the American Society of Municipal Improvements at Grand Rapids began according to program with the meeting of the committee on standard specifications on Monday, Sept. 25 at 10 a. m. Three sessions on Monday two

E. A. KINGSLEY, President, Little Rock, Ark.

on Tuesday and brief sessions on Wednesday and Thursday noons were required to cover the discussion of the sub-committee reports presented and pass them to the society, and one, that of wood block was postponed for another year on account of inability to agree upon a report. The plan followed in these discussions is outlined in



B. E. BRIGGS, Vice-President, Erie, Pa.

the editorial department on a previous page.

The Society sessions proper began Tuesday at eleven with the usual preliminaries and official reports and the afternoon was devoted to a trolley ride about the beautiful streets and parks of Grand Rapids.

The real business of the convention began with the evening session and continued with two sessions a day until Friday noon. The program sustained the reputation of this society for high quality and included the following papers and reports:

"Maintenance and Development of Parks" by H. S. Richards, South Park Commission, Chicago; one on municipal methods by W. C. Meyer in charge of statistics of cities in the U. S. Census Bureau; "Bituminous Concrete Pavements" by H. G. Lykken, city engineer , Grand Forks, N. D., with a discussion by Geo. C. Warren, Boston, Mass., abstracts of which will be found on pp. 345 and 349 of this number; "Notes and Queries on Grouted and Sand Filled Brick Pavements" by Maury Nicholson, city engineer, Birmingham, Ala.; "Some Observations in Matters of Contraction and Expansion of Vitrified Brick Street Pavements" by Will P. Blair, secretary of National Paving Brick Manufacturers' Association, these two papers to be found on pp. 269 and 273 of the October number of MUNICIPAL ENGINEERING; "Asphalt Cements for Sheet Asphalt Pavements" by J. W. Howard, consulting engineer, New York City, which is given on p. 342 of this number. Special attention is called to the valuable table in this paper and to the general conformity of the standard specifications for asphaltic cements adopted by the society with the results of the tests of good cements shown in the table; "Bitucrete" by A. E. Schutte, Boston, Mass., which will appear later; "Municipal Water Purification Plant of Grand Rapids" by Geo. W. Fuller, consulting engineer, New York city; "Sewage Disposal" by Langdon Pearse, Chicago Sanitary District; "Some Examples of Ornamental Street Lighting" by Jos. E. Putnam, assistant city engineer, Rochester, N. Y.; "The Sanitation of Swimming Pools" by Melville C. Whipple and John W. M. Bunker; "Rebuilding of a Brick Sewer" by Edward S. Rankin, engineer of sewers and drainage, Newark, N. J., which was printed on p. 284 of the October number of MUNICIPAL ENGINEERING.

Reports of committees on garbage disposal, park maintenance and development, municipal legislation and finance, municipal data and statistics, street paving, traffic on streets, water works and water supply, sewerage and sanitation were presented.

The reports of the committee on standard specifications and of its sub-committees on brick paving, wood block paving, bituminous paving nomenclature, asphalt paving, and sewers occupied the greater part of two sessions of the convention in addition to the time in open committee meetings above described.

E. H. CHRIST, Vice-President, Grand Rapids, Mich.

W. B. HOWE, Vice-President, Concord, N. H.

The city of Grand Rapids was lavish with its entertainments for members and their ladies. The banquet of Wednesday evening and the inspection of municipal work on Thursday morning deserve special attention. The latter included the new water works pumping station and electric light station, the latter not yet completed, the filtration plant under construction, sewage pumping plants, station for dumping garbage into cars, flood walls, and miles of first class brick pavements, bitulithic, asphalt, and some wooden block and the newer bituminous surfaces for streets.

The accompanying photograph of nine presidents and past presidents of the society shows the permanence of the membership, notwithstanding frequent changes in official positions, and the interest which the members continue to show in the society by attending its conventions. In order from right to left the record of these ex-presidents, members ex-officio of the executive committee, is as follows, beginning with those standing: George W. Tillson, consulting engineer for Brooklyn, N. Y., became a member in 1896, was secretary of the society 1901 to 1907 and was president in 1908. Morris R. Sherrerd, chief engineer, Newark, N. J., became a member in 1896 and was president in 1907. Charles H. Rust, city engineer, Toronto, Ont., became a member in 1898 and was president in 1903. Edwin A. Fisher, city engineer, Rochester, N. Y., became a member in 1896 and was president in 1902. Charles Carroll Brown, consulting engineer, Indianapolis, Ind., became a member in 1895 and was president in 1906. Fred Giddings, C. E., Atchison, Kan., became a member in 1896 and was president in 1911. James Owen, consulting engineer, Newark, N. J., became a member in 1904 and was president in 1909. Edgar A. Kingsley, consulting engineer, Little Rock, Ark., became a member in 1908 and is the president for 1912. A. Prescott Folwell, editor, New York city, became a member in 1901 and was president in 1905 and is the present secretary.

The election of officers moved the vice presidents up one step and made E. A. Kingsley, Little Rock, Ark., president, B. E. Briggs, Erie, Pa., Edward H. Christ, Grand Rapids, Mich., and W. B. Howe, Concord, N. H., vice presidents. A. Prescott Folwell and E. S. Rankin were continued as secretary and treasurer.

Dallas, Tex., was selected as the next place of meeting.

PRESIDENT AND PAST PRESIDENTS OF AMERICAN SOCIETY MUNICIPAL IMPROVEMENTS .

American Road Builders' Association Meeting at Rochester, N. Y.

The preliminary circulars of the congress to be held by the American Road Builders' Association at Rochester, N. Y., Nov. 14 to 17, are devoted to the names of state governors and the delegates they have appointed to the congress and to the names of applicants for exhibit space. The program is reported as not yet completed, but, to judge from previous conventions, should be well worth hearing. No local arrangements are announced, and the only reduced rates are in the territory of the Trunk Line Association. Harold Parker, chairman of the Massachusetts Highway Commission, is president, and E. L. Powers is secretary.

The International Association of Fire Engineers.

The thirty-ninth annual convention of the International Association of Fire Engineers, held in Milwaukee on September 19-22, was unanimously voted to be the greatest ever held from the standpoint of attendance and educational value. Six hundred fire chiefs from all parts of the United States and Canada were in attendance, and were entertained between business sessions by the citizens of Milwaukee.

Automobile fire machinery was the chief topic discussed in the convention hall and hotel lobbies. There were thirty-seven pieces of motor-driven apparatus shown in the exhibition hall, consisting of chief's cars, combination chemical and squad cars, hook and ladder trucks and gasoline fire engines. The largest piece shown was a two-hundred horse power Knox truck, with a huge pump carried amidship, which is driven by the same engine that propels the vehicle.

W. H. Loller, chief of the Youngstown, O., fire department was elected president, and Denver was selected as the next place of meeting. Other officers elected were: First vice-president, H. F. Magee, Dallas, Tex.; second vice-president, Thomas Haney, Jacksonville, Fla.; secretary, James McFall, Roanoke, Va., re-elected; treasurer, George Kloflock, Mansfield, O.

Technical Associations.

At a regular meeting of the Brooklyn Engineers Club on October 12, William J. Grinden presented a paper on "All Metal Construction of Doors and Trim for Fire-proof Buildings."

Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, presented a paper on "The City Plan and What It Is," before the regular meeting of the Municipal Engineers of the city of New York, held on September 27.

Among the topics discussed before the fourteenth annual convention of the National Firemen's Association, held in St. Louis on September 25 to 27, were the following: "Fire Apparatus, Past, Present, and a Glimpse Into the Future" by Ex-Chief Geo. C. Hale, Fire Commissioner, Kansas City, Mo.; "Should Not the Chief of the Fire Department be Consulted and Apprised of all Building Permits and Have Power to Compel the Cleaning up and Building of Stairways, Elevators, Etc"; "Are Not Firemen the Poorest Paid Employees of the Municipality, Duties Considered?" by Capt. Wm. Roth, Rochester, N. Y.; "Is the Revolving Gear or Rotary Style Pump, or Reciprocating or Vertical Type, as used on Steam Fire Engines, Best Suited for the Motor Driven Apparatus of the Day, from the Points of Simplicity of Construction, Economy of Operation and Durability of Machine?" by M. M. Thos. M. Robinson, Washington, D. C., Chairman Topic Committee; and "Solid vs. Pneumatic Tires on Motor Driven Apparatus from Points of Speed, Safety and Economy" by T. E. Smith, Akron, Ohio.

The permanent International Association of Road Congresses has issued the first number of its periodical bulletin. This issue contains the minutes of the proceedings of the permanent International Commission, a number of abstracts of papers given before the recent Brussels conference, and other contributions.

The official report of the conference of the State Immigration officials, held in Chicago on July 24-26, 1911, has been issued by A. B. Hulit, Commissioner General, 10 E. Jackson Boulevard, Chicago, Ill. It contains an outline of the purposes of the organization, which are primarily to encourage the "back to the farm" movement, and to provide an instrument for bringing the man and the land together.

At a regular meeting of the New York Electrical Society held on October 27, Maj. George O. Squier of the U. S. Signal Corps, presented a paper on "Electric Waves Directed by Wires for Intercommunication Purposes."

C. A. Crane, secretary of the General Contractors Association, gave an illustrated paper on "The Contractor's View of City Contracts and Specifications," at a regular meeting of the Municipal Engineers of the City of New York.

Municipal control of water works was the principal topic of discussion at the sixteenth annual convention of the Pennsylvania Water Works Association, which met in Atlantic City on October 18-20. L. E. Chapin, consulting engineer, Pittsburg, Pa., delivered an address on "The Conservation and Storage of Water," and an address on "Municipal and State Control of Public Utilities" was delivered by J. H. Purdy, also of Pittsburgh. Among the other speakers were Edgar Munson, of Williamsport, Pa., who spoke on "Appropriation of Water Under Pennsylvania Statutes," and J. M. Chester, of Pittsburgh, who took as his topic "Water Companies vs. Insurance Companies."

The Board of Trade of Newark, N. J., is

taking an active interest in the questions of civic betterment. Among the papers presented at a banquet of the organization held on October 18, were the following: "First Need of City Planning," by David Grotta; "Public Welfare and Public Safety," by Dr. R. G. P. Dieffenbach; "Transportation and Traffic," by Joseph H. Wood; "Municipal Administration," by J. Harry Bacheller.

A special meeting of the Cleveland, O., Engineering Society was held September 26. A paper on "Smoke Prevention," was presented by Paul P. Bird, of the Commonwealth Edison Company, Chicago, formerly Chief Smoke Inspector of Chicago.

At a regular monthly meeting of the American Society of Engineering Contractors held in New York City on September 17, Myron H. Lewis gave an illustrated lecture on "Waterproofing as a Means of Insurance."

The first annual meeting of the American Society of Engineer Draftsmen was held at the Teacher's College, Columbia University, New York City, on October 3. Walter M. Smyth, 116 Nassau St., New York City, is secretary.

At the regular meeting of the Engineers' Club of St. Louis, held on October 4, Charles W. Martin, engineer in the bridge division of the St. Louis street department, presented an illustrated paper on "Methods of Reinforced Concrete Design."

At the regular meeting of the American Society of Civil Engineers, held in New York City on October 4, a paper, by Mr. Wilson Sherman Kinnear, entitled "The Detroit River Tunnel," was presented for discussion. This paper was printed in the August "Proceedings."

The National Builders' Supply Association have decided to hold their next annual Convention in New York City in conjunction with the Second Annual New York Cement Show on January 29 to February 3, 1912. The meeting of this organization in connection with the New York exhibition will mean a very large attendance of the building material interests from all parts of the United States.

At the recent meeting of the Central States Water Works Association at Cleveland, the following officers were elected: W. J. Scroggins, president; W. A. Veach, vice-president; R. P. Bricker, secretary, and A. W. Inman, treasurer.

Calendar of Technical Meetings.

National Municipal League.—Annual Meeting, Richmond, Va., November 13-16. Clinton Rogers Woodruff, secretary, 705 North American Building, Philadelphia, Pa.

American Road Builders' Association.—Annual Convention, Rochester, N. Y., Nov. 14-17. E. L. Powers, 150 Nassau street, New York, N. Y., secretary.

League of Nebraska Municipalities.—Annual meeting, Omaha, Neb., November 15-17. R. C. Ozman, secretary, Lincoln, Neb.

American Association for Highway Improvement.—First annual convention, Richmond, Va., November 20-24. Logan Waller Page, president, United States Office of Public Roads, Washington, D. C.; J. E. Pennypacker, Jr., secretary, Colorado Building, Washington, D. C.

New Jersey Sanitary Association.—Annual meeting, Lakewood, N. J., November 24-25. J. A. Exton, secretary, 75 Beech street, Arlington, N. J.

American Public Health Association.—Annual convention, Havana, Cuba, December 4-9. William C. Woodward, M. D., secretary, District Building, Washington, D. C.

Second Annual New York Cement Show.—Madison Square Garden, January 24- February 3, 1912. J. P. Beck, General Manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Fifth Annual Chicago Cement Show.—Coliseum, February 21-28, 1912. J. P. Beck, General Manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

First Annual Kansas City Cement Show.—Convention Hall, March 14, 21, 1912. J. P. Beck, General Manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Technical Schools.

President McLaurin of the Massachusetts Institute of Technology announced on October 10 that a 50-acre tract of land on the Cambridge side of the Charles River Basin, between the Harvard and West Boston bridges, has been selected for the new home of the college. This selection is contingent on favorable action by the Cambridge municipal authorities on closing certain streets. The property is stated to be valued at $750,000 and T. Coleman du Pont, of Wilmington, Del., is said to have agreed to furnish two-thirds of this amount.

Paul Hansen, State engineer of Kentucky, has been appointed associate in sanitary engineering at the University of Illinois and engineer to the Illinois State Water Survey. Prof. Edward Bartow is director of this survey, which has an appropriation of $20,000 for making a study of the water supplies of the State.

R. B. Kittridge has been appointed instructor in civil engineering at the University of Maine. A. T. Childs has been appointed assistant professor of electrical engineering at the same university.

F. C. Lincoln, M. Am. Inst. M. E., has been appointed Associate in mining engineering at the University of Illinois. For the past year Mr. Lincoln has been in practice as a consulting engineer in New York City, and he was formerly Professor of geology of the Montana School of Mines. He is a graduate of the Massachusetts Institute of Technology.

Langdon Pearse, of the Sanitary District of Chicago, delivered an illustrated lecture on "Sewage Disposal" before the Civil Engineering Society of Purdue University on Oct. 5. The work of the Sanitary District and the scope of the testing station were described.

L. D. Rowell, formerly Assistant Professor of electrical engineering at the Case School of Applied Science, has been engaged to take charge of the electrical laboratory

of Purdue University at Lafayette, Ind. He is a graduate of the University of Wisconsin, Class of 1901. A. D. Du Bois will have charge of the junior electrical laboratory under Mr. Rowell's direction. Mr. Du Bois is a graduate of the University of Illinois, Class of 1899, and has recently been an instructor at Cornell University.

Prof. Arthur H. Blanchard, professor of highway engineering at Columbia University, New York City, has issued a booklet describing the graduate course in highway engineering at that institution.

Personal Notes.

Charles H. Pieper, city engineer of San Jose, Cal., died in that city on Oct 1.

Chas. E. Hoover, Columbus, O., has been appointed chief chemist, in charge of the water purification plant.

Maurice E. Connolly, city magistrate of Queens, has been elected Boro President, to succeed Lawrence Gresser.

William H. Catlin, superintendent of highways of the State of New York, died at Port Chester, N. Y., on October 5.

Leo Hudson has been appointed consulting engineer of the borough of Duquesne, Pa., and will be engaged in matters in relation to the sewerage system.

Arthur H. Blanchard, M. Am. Soc. C. E., consulting highway engineer, formerly of Providence, R. I., announces the removal of his office and laboratory to Broadway and 117th street, New York City.

Mr. Herbert T. Salmonde has been appointed chemist and bacteriologist at the Mundale filters in Springfield, Ill. He has been recently connected with the Chicago Board of Health, as bacteriologist.

James E. Gibbons has resigned his connection with the New York Board of Water Supply, where he has been engaged on the Hudson River siphon and is now in charge of the work on the Fourth avenue subway in Brooklyn.

C. R. Young, lecturer in structural engineering in the University of Toronto, and late of Barber & Young, structural engineers, of that city, has opened on office as consulting engineer at 318 Continental Life Building, Toronto.

Wm. R. Benson, chief of the bureau of Highways and street cleaning of Philadelphia, Pa., with a salary of $6,000, has been dismissed by Mayor Reyburn for "disloyalty to the administration," as the result of a political disturbance.

Alfred Craven, M. Am. Soc. C. E., has been appointed chief engineer of the Public Service Commission of New York City. Mr. Craven had been acting chief engineer since the resignation of Henry B. Seaman, M. Am. Soc. C. E., in September, 1910.

Under a new administration in the city of Baltimore, Md., H. K. McCay has been appointed city engineer and Edgar B. Whitman named as water engineer. Mr. McCay has been recently associated with the McCay Engineering Company, of Baltimore.

O. H. P. Cornell, a civil engineer and son of Ezra Cornell, the founder of Cornell University, died at Winston-Salem, N. C., on October 13. He was a graduate of that university in the class of 1874, and had been engaged for a number of years in railroad work.

Alexander R. McKim, consulting engineer, New York, has been retained by the New York State Conservation Commission to conduct an inquiry into the condition of dams and reservoirs in the State for the purpose of taking such precautions as are necessary to eliminate danger of failure.

At a recent meeting of the Louisiana State Board of Engineering Examiners, at New Orleans, officers were elected as follows: Ira W. Sylvester, president; F. H. Waddill, vice-president; Mr. Marcel Garsand, secretary, and B. W. Peagues, chairman of the committee on examination papers. These are all re-elections from the last term of service.

Henry A. Young, Assoc. M. Am. Soc. C. E., formerly of the Jobson-Hooker Co., New York City, and Howard E. Hyde, Assoc. M. Am. Soc. C. E., formerly engineer in charge of designs of the Havana, Cuba, sewerage and drainage systems, have formed a partnership for the practice of civil and sanitary engineering with offices in the Produce Exchange Bldg., New York City.

Wm. R. Copeland has resigned as chemist in charge of the water-purification plant at Columbus, Ohio, and on Oct. 1 began service with the Metropolitan Sewerage Commission of New York (17 Battery Place, New York City), where he will have the title of chemist. He will have charge of investigations which are being made by the Commission to throw light on the capacity of New York Harbor to assimilate sewage without offence.

Dr. N. C. Ricker, Professor of Architecture, and Professor I. O. Baker, in charge of the Department of Civil Engineering of the University of Illinois, have been appointed by Governor Deneen as members of the Commission to Revise and Codify the Building Laws of the State of Illinois, which Commission was authorized by the last General Assembly of the State. The other members of the Commission are Mr. R. E. Schmidt, Mr. W. C. Armstrong and Mr. W. S. Stahl of Chicago, Mr. W. H. Merrill of Lake Forest and Mr. G. J. Jobst of Peoria. Dr. Ricker is Chairman of the Commission.

The firm of Wannenwetsch and Company, composed of C. H. A .Wannenwetsch, A. C. Lembke and R. T. G. Liesinger, doing a general architectural and engineering business, has been dissolved by mutual consent. Charles H. A. Wannewetsch has formed a partnership with his brother, Andrew T. Wannenwetsch, under the firm name of C. H. Wannenwetsch and Company, to engage in the general architectural and engineering business and to manufacture sanitary rendering and drying machinery and apparatus together with other packing house and reduction machinery, with office in Citizens Bank Bldg. at No. 563 William Street, Buffalo, N. Y.

Walter Herbert Sears, for about five years chief engineer of the Aqueduct Commissioners, in charge of the extensions of the Croton water supply of the city of New York, died Oct. 7 at his home in Plymouth, Mass. Mr. Sears was born in Plymouth, in 1847, and graduated from the Massachusetts Institute of Technology in 1868. In 1904 he became division engineer of the Croton River Division of the Aqueduct Commissioners and had charge of work in the vicinity of Katonah, N. Y. From August 1, 1905, to January 9, 1906, he was acting chief engineer, and from the latter date to April 1, 1910, chief engineer of the Aqueduct Commissioners. During this period the Cross River reservoir was completed and the Croton Falls reservoir construction begun and carried nearly to completion.

Ornamental Street Lighting in Warren, Ohio.

The business district of Warren is at the present time lighted by 86 ornamental standards, two of which are of the five light cluster type, the top one being 80-watt and an all-night lamp, while the remainder are 40-watt lamps burning until midnight. Along the park side of two of the business streets are 22 single-light standards, four of which are equipped with 50-watt lamps, which burn all night; and 18 of which are equipped with 60-watt lamps that burn until midnight. On the opposite side of the business streets are 62 three-light standards, of which the top lights on fifty-one burn all night, the pendants of these fifty-one being turned off at midnight, while the top light and pendant lights of the other eleven are extinguished at midnight. The ornamental standards in the business district are equipped as follows:—top lights are enclosed in 14-inch Alba glass ball globes and the pendants in 12-inch ball globes. The absorption of these globes is specified to be a maximum of 15 per cent.

The metal posts are of charcoal iron, the column being of Corinthian design, with Doric top, while the base is a cast iron square, anchored to a 2½ ft. cube of concrete. The cross arms are at right angles with the curb line, and are of 36-inch spread.

All single light standards are made and wired so as to permit attaching cross arms later similar to the three-light standards and, as above stated, the one-light standards are all placed on the park side of the business streets, while the three-light standards are on the business side of the streets.

All ornamental standards are connected through an underground system and in the park and such other places where it was not necessary to take up pavement, the wires are laid in a lead covered cable, armored with steel tape, wrapped with jute and compound. In places where it was necessary to take up pavement a 2½-inch fibre conduit was laid immediately below the foundation of the pavement and enclosed in concrete. Through this conduit was drawn the usual lead covered cable.

The spacing of the ornamental standards in the business districts varies from 65 to 80 feet, according to the requirements of the street, each street having a uniform spacing. This arrangement gives a candle power per lineal foot varying from 3.4 c. p. to 4.2 c. p. per lineal foot of street. Street intersection lighting is arranged by placing the ornamental standards at the point of intersection of the street line extended and the curb line, thus providing ample lighting for all cross walks. The center of the standard is set back 18 inches from the face of the curb lines, thus bringing one pendant lamp over the curb, and the other over the sidewalk. This uniform alignment gives a pleasing effect.

The residential district is provided with all-night service. The spacing on the street varies from 115 feet to 300 feet between the lamps. There are installed 211 80-watt lamps, 90 60-watt lamps, and 355 40-watt lamps. Main thoroughfares are favored in the closeness of spacing and the candle power of lamps. The overhead wiring system is followed in the residential district. Lamps are installed along the same side of each street, giving a continuous line of lighting, the plan followed being first to place a light at street intersections thus giving double efficiency at such points. Intermediate lights between street intersections are placed at equal distances, care being taken to have spacing on each street uniform. Goose neck brackets attached to wood poles is the plan of suspension of the lamps in the residential

STANDARDS FOR ORNAMENTAL LIGHTS IN WARREN, OHIO.

districts. Radially fluted steel enameled reflectors 18 inches in diameter are placed over each of these lamps. Unnecessary duplication of poles is avoided by using poles of telephone, telegraph, and other companies where premission could be secured to do so.

A recording ammeter is located on the main feed wire of the municipal lighting system, and a meter record is kept and furnished the city council quarterly, the same being used as a basis of paying for the service; although the basis of the contract is a flat rate per lamp per year. Every street in the city is lighted to the corporation limits. The full amount of $13,000 paid by the city for this new lighting system is cut down somewhat by revenue received from the railway companies for the lighting of railway crossings, by virtue of a law in the State of Ohio.

The old lighting system which was superseded by the tungsten installation consisted of 161 open arc Brush lamps of 9.6 amperes. The operation of this system up to midnight with a few all night lamps cost the city $10,800 per annum, while the new lighting system, using the Mazda tungsten lamps, and giving all night service all over the city, costs $13,000 per annum. Twenty per cent. of the streets are lighted by this new system than were lighted before, while the streets formerly lighted by the arc lamps are now illuminated better than by the former method. The kilowatt consumption under the new method is thirty per cent. less than by the old method.

The installation of the new ornamental system was made by the Sterling Electrical Manufacturing Co. of Warren, O.

The accompanying photograph shows the type of standard adopted and gives some idea of the system. The float is one of a number which appeared in a festival parade held in celebration of the completion of the lighting system.

Calcium Chloride in Road Construction.

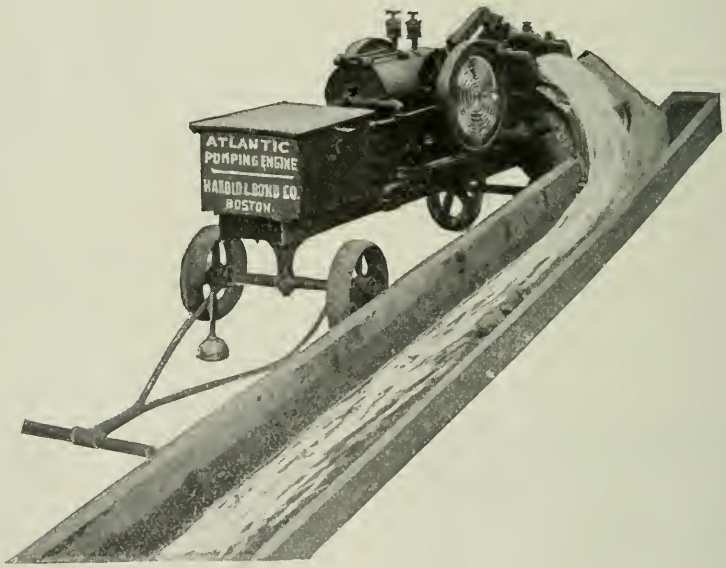
Calcium chloride has the properties of a sponge, and will absorb and carry large quantities of water; this absorption is rapid, but the evaporation is slow, so slow that a treated roadway will keep the dust down ten times as long after a rain or wetting as it will stay down on an untreated one. The chemical gathers moisture from rain, frost, damp air or dew, and with a normal fall of dew will gather moisture each night to keep the road in good condition the next day, even when the full absorption of a rain has been evaporated; but, like the sponge, it will dry out, in long and excessive dry spells, and must have an artificial wetting if perfect conditions are desired. It also has the characteristics of the leech and will attach itself to any porous substance it may be on or against, at time of saturation, and like the leech, once attached is removed with difficulty. Though soluble in water, the chemical used on this road work is 80 per cent heavier than water and so can not lift and flow with it. This ensures a long and continuous service, in fact a large part of the chemical will carry over from year to year.

The construction of a road by the use of calcium chloride differs but little from the ordinary gravel or macadam construction. A base of 4 to 6 inches is provided and compacted so that the voids are entirely filled. Upon this base is spread a layer of sand using a cubic yard of sand and 75 lbs. of the calcium chloride, which are thoroughly mixed together by turning as in mixing concrete. Then spread same about 6 inches deep, and dump on to it 1½ cubic yards of screened half to one-inch gravel or crushed stone (don't use stone screenings as a filler, as the chemical will not mix with them as well as with sand); then cut and tumble this until the sand is filled into the voids; the dampness of the sand will cause it to hold its place in the stone voids. Spread this 3 to 4 inches thick, and if convenient roll it, if not let the traffic over it pack it. In this case it will be necessary to work the top a little with a rake or scraper, pushing the displacements back until the road is well ironed down with this traffic; but this can generally be done cheaper than the road can be rolled, and once it is packed this way it is there for all time. If any soft spots or depressions develop, simply fill on top until a bottom is found. This top sand, chemical and stone mix may be made and left anywhere for any length of time. If it has become dry from long exposure, simply throw on a few pails of water before spreading and compacting.

Surfaces used as railways, highways and by-ways, or walks, should be kept clear of weeds and all kinds of vegetable growths. The chlorides are vegetable poisons as well as dust layers, and so not only keep down the dust on the roadways, causing the top body of same to pack and remain firm and smooth, but they also so poison the soil composing these surfaces that a weed or vegetable will not grow on them, nor will seed germinate in them. Still the application of these chlorides in quantities sufficient to lay dust and kill weeds on the road surface will not injuriously affect or damage adjacent trees, shrubs, grass or flowers on the lawns.

The Howe Chemical Road Company of Detroit, Mich., have patented this process of road construction and are providing calcium chloride manufactured by the Saginaw Chemical Works, Saginaw, Mich., for use in this connection.

EIGHT MEN AT $14.00 A DAY PUMP THE SAME VOLUME AS



ONE GALLON OF GASOLINE IN THIS ENGINE DRIVEN PUMP.

An Economical Contractor's Pump.

The two photographs given herewith offer a graphical comparison of the old man power and the modern gasoline engine-driven contractors' pump. The power pump shown is one manufactured by the Harold L. Bond Co., 383 N. Atlantic avenue, Boston, Mass. The capacity of this pump equals that of the two diaphragm pumps shown. The cost of pumping in the case of the hand pumps was eight men at $1.75 each, or $14, as against one gallon of gasoline for the engine-driven pump. In addition to this factor of economy, the engine-driven pump may be operated continuously, requiring only occasional attention to renewing the gasoline and oil. A very conservative estimate places the saving of the gasoline pump over the hand pumps at $12 a day.

The gasoline pump is designed for use by

contractors or foundation, drainage or sewerage work. With this use in view, the engine has been made very simple in design, so that it may be readily comprehended by even unskilled laborers.

The engine has 3½-inch bore, 3½-inch stroke, and a normal speed of 500 revolutions per minute. Speed may be changed while in operation from 300 to 700 revolutions per minute without injury. This gives a speed to the pump from 30 to 50 strokes, as may be desired. The fly-wheel is 14 inches in diameter. The engine has jump spark ignition and Lukenheimer special generator valve.

The cylinder is cast in form of a sleeve, properly bored inside and machined outside, thus providing cylinder walls of uniform thickness. The water jacket and cylinder construction make the engine absolutely frostproof, and no serious damage can follow even though water was allowed to freeze solid in the water jacket. The engine is provided with a special speed regulating device which operates on the governor, by increasing the tension of the spring on the governor weight, and at the same time advancing the timing of the spark.

Every part of the engine is made to template, insuring interchangeability of parts. Each engine is thoroughly tested before shipment, and a record kept of its brake horse power delivered. The whole outfit is attached to channel iron frame, mounted on low cast iron wheels with swivel front axle and drawing handle. The batteries, coil and starting switch are in the battery box. The electrical equipment consists of six batteries and a jump spark coil in connection with a mica spark plug. The gasoline tank has a capacity of one gallon, sufficient for operating the pump eight hours.

The pump is fitted with a guaranteed diaphragm of best quality. It is a side inlet pump with connection for three-inch suction hose.

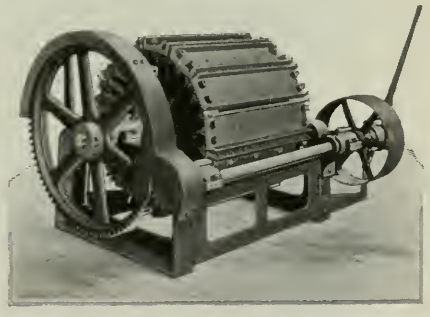
The Standard Brick Rattler.

The Ceramic Supply & Construction Co. of Columbus, Ohio, have placed on the market a brick rattler constructed exactly according to the specifications adopted by the National Paving Brick Manufacturing Association in 1911. A photograph of the machine is shown herewith. A full account of the provisions of the specifications has been given in these pages, but the following points in which the improved rattler differs from the old type may be noted.

The head of the rattler barrel is a regular 14-sided polygon inscribed in a circle 28⅜ inches in diameter. This head is provided with outward extending flanges to which may be fastened the staves which make up the sides of the barrel. The inner side of the head is lined with a cast iron liner one inch in thickness but only 28¼ inches in diameter. This liner is fastened by seven screws fastened through from the outside. These liner plates are to be replaced upon becoming worn to a depth of ½ inch. They are constructed from a hard metal as hard as machinery iron and containing not less than one per cent. of combined carbon.

The staves are made of 6-inch medium steel structural channels 27½ inches long and weighing 15.5 pounds per lineal foot. The inner side of each channel is protected by a lining or wear plate ⅜ inch thick and 5½ inches wide by 19¾ inches long. The plates are constructed from medium steel and are riveted to the channel staves by 3½-inch rivets, the rivets being countersunk on the faces of the wear plates. It is provided that no set of wear plates shall be used for more than 150 tests.

As will be noted the provisions for replacing the barrel head and stave linings when they become worn, provide a constant volume within the barrel of the rattler; and therefore uniform conditions of test even though different machines are used. The driving gear and pinion on the Ceramic Supply & Construction Co. machine are protected by a safety device and a clutch is provided whereby the revolutions of the barrel may be stopped upon the required number of revolutions.



THE STANDARD SUPPLY AND CONSTRUCTION CO. STANDARD BRICK RATTLER.

W. D. Richardson, president of the Ceramic Supply & Construction Co. was chairman of the committee of the National Paving Brick Manufacturers' Association which drafted the original specifications for the standard rattler test in 1901. The company has made a specialty of the manufacture of rattlers together with screens, conveyors, elevating and power transmitting and other clayworking machinery. The fact that they specialize in this line indicates that they are particularly competent to make the standard rattler.

Spreading Dump Cars for Road Work.

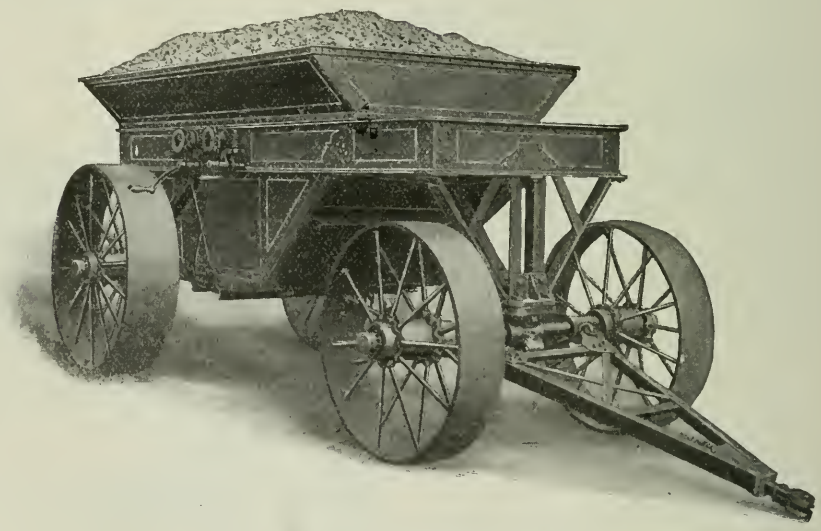
One class of machinery to which little notice has been given, though it has been one of the most potential factors in road construction, is the "dump car" wagon, which has come into universal use on all large road contracts. The first of this type of carrier was a spreading dump car, invented and built by the Port Huron Engine and Thresher Company, of Port Huron; Mich., and used in the construction of a half mile sample stretch of road, built by the United States government. This was on the occasion of the first International Good Roads Congress, held in Port Huron, Mich. Since that time the spreading dump car has been developed to a high degree of perfection by its inventors.

The "1910 model" of the Port Huron spreading dump car is shown in the accompanying photograph. It is constructed of steel throughout, with broad wheels, which not only provide against cutting or rutting the subgrade, but, on the other hand, roll and compact the surface over which they pass, by reason of the front wheels being partly inside the back wheels, so that the total width of track is 20 inches.

Port Huron roller, with eight or a less number of cars, can be turned completely around without uncoupling or backing.

The cars are furnished either "spreading" dump or "full" dump, or both. The "spreading" dump provides for spreading crushed stone, gravel, etc., over the roadway, 1 to 8 inches deep and 4 to 4½ feet wide, according to the adjustment of doors, size of particles, evenness of ground, etc. The "full" dump type provides for opening the bottom and dumping all of the material at once. The bottom doors are set "crosswise" instead of "lengthwise," as in the case of the usual horse-drawn wagons. They have a carrying capacity of 7 tons, or 3¼ to 3¾ cubic yards, depending on the top box being level full or "heaped." Either horse hauling or engine drawing hitches are provided.

A train of the dump cars, hauled by a traction engine or road roller, is the most economical method for distributing road material. An extensive use of this sort of "train" hauling or road work throughout the eastern states has resulted in a saving of from $125 to $8,000 per mile of road built, over the old methods of hauling.



THE PORT HURON SPREADING DUMP CART.

The dumping levers are set low, so as to provide for their convenient operation by a man standing at the side of the wagon. The frame is of steel (channel sections being used) and is hot-riveted throughout to the steel body. The wheels are provided with roller bearings, lessening the tractive resistance of the car. The under-cut feature allows of the car turning clear, and the extended hitches allow it to travel outward and nearly on the track of the roller. A regular

A New Selling Company for Menzies Street Cleaning Company.

The Matchless Street Cleaner Company, Glen Falls, N. Y., now have the exclusive sale of the Matchless Sanitary Hand Cleaning Machines and Matchless Spring Steel Snow Shovels and the Menzies Street Cleaner company do not manufacture or sell the same. All inquiries and orders should be made to the Matchless Street Cleaner Company to insure prompt reply and shipment.

The Eclipse Low Charging Mixer on Bituminous Road Work.

The accompanying illustration shows one of the "Eclipse" low charging mixers driven by gasoline engine, all mounted on low-set truck, mixing "Tarvia" for road work in Rutherford, N. J. The contractors, P. & P. Jannarone, of Belleville, N. J., report having done this work very rapidly and with less expense than by other methods. The tar was melted in the usual way and poured into the drum from the platform which is shown in the illustration,, and thoroughly mixed with the crushed stone. The photograph shows two wheelbarrow loads of the mixed tar and stone as discharged from the mixer. The machine ran clear and worked rapidly without any trouble from the tar mixture hardening or caking around the blades. In order to keep the drum warm, so that it would not chill the tar, a sheet-iron fire box about 24 inches square and 12 inches deep was kept under the mixer drum with a small wood fire in it; and this answered all purposes and made a very cheap and effective outfit for this class of street paving work, and was entirely satisfactory to the contractor, as well as the engineer.

P. & P. Jannarone are now using the mixer for concrete on another class of street paving work. The manufacturers, The Standard Scale & Supply Co., 1345 Wabash avenue, Chicago, Ill., have recently closed some large and very desirable contracts for mixed equipments for bridge builders' use and on other classes of contracts.

A Municipal Garbage Incinerator and Steam Generator.

The Nashville Bridge Company of Nashville, Tenn., is at present constructing the first of a new type of incinerator and steam generator. This incinerator was invented and has been patented by J. B. Harris, M. D., who also invented the Harris Smokeless Furnace. It is claimed for the incinerator that it is odorless and smokeless and that it will provide sufficient steam for the operation of a municipal light plant of a size adequate for a town for which the incinerator is designed. The following are the essential features of the incinerator:

Four main drums or headers such as are used in Sterling boilers are set longitudinally; one large drum being placed in the center and connected by a system of pipes to two smaller drums in the same horizontal plane, and also to another large drum placed directly beneath it. The two smaller drums are connected to the lower or "mud drum." A baffle wall runs up back of the vertical pipes connecting the upper and lower center drums. A fire box equipped with a Harris smokeless furnace attachment is placed beneath and to one side of the mud drum. The path of the gases is as follows: The heated gases rise from the fire grate about the water pipes connected with the "mud" drum to one of the side drums and about the horizontal pipes from the side to the center drum. Thence they pass over the baffle wall and are deflected down about the other set of

MIXING BITUMINOUS CONCRETE WITH AN "ECLIPSE" MIXER.

horizontal pipes and also the diagonal pipes from the other side drum to the "mud" drum, and leave the furnace at a point but slightly above the charging door on the opposite side. A by-pass arrangement is provided whereby the gases may either proceed directly to the stack, or through a superheater connected with the upper center or "steam" drum.

The method of operation of the incinerator, as described, seems to provide for complete and odorless incineration. The material is dumped through a funnel-like hopper, which is made to revolve so as to distribute the refuse uniformly over the grate formed by the upper horizontal water tubes. Here it is dried by the hot gases which pass upward through the material on one side and downward on the other; this drying continuing until the refuse is dry enough to stoke through upon the diagonally placed tubes where the incineration proceeds. All materials, such as tin, old iron, scraps, etc., in the unpicked garbage are to be raked from the tubes before recharging.

Drainage is provided for by making the charging floor slope to a down pipe which will conduct the liquid down and through a pipe extending upward to a series of pans placed in a terrace like position with reference to each other. Here the greatest possible surface of liquid will be exposed to the hot gases leaving the furnace and evaporation will take place.

The roof of the incinerator is placed at some distance above the horizontal grate surface. The provision whereby both the upper and lower grates are placed in front of the bridge baffle wall, combined with the space provided over the upper grate are the features by which it is claimed the furnace will be operated without odor. It is stated that the sulphuretted hydrogen and other disagreeable gases, being lighter than the carbon dioxide products of combustion, will rise to the top of the furnace and there against the curved roof will be burned to sulphuric anyhdride plus carbon dioxide plus water which are without odor and heavier than the sulphuretted hydrogen, and will be discharged through the stack.

As for the steam generating efficiency of the plant, the following figures are stated by the inventor: "Figuring the two water drums of the boiler to be 16 feet from the center, the area of heating surface is 788 square feet, and all tubes and drums are designed to carry a gauge pressure of 150 lbs. At this pressure the boiler will carry a load of 1100 to 1200 horse power, and a garbage capacity of 150 tons."

The incinerator is to be built in units of 10 tons to 250 tons capacity per 24 hours, and generating from 100 h. p. to 1200 h. p. per unit. Further information may be obtained from J. B. Harris, M. D., 210 Stahlman Bldg., Nashville, Tenn.

A Durable Sewage Ejector System.

Trouble is often experienced in pumping sewage, by reason of the fact of the chemical action of the sewage and gases upon the moving parts of the pump, resulting as it does in the rapid deterioration of these parts. At the same time it is sometimes necessary, and often desirable, to raise the sewage, either by reason of bringing it to a high level trunk sewerage system, or because the grade line of the sewer must be changed.

The Priestman ejector system, manufactured by Merritt & Co., 117 North Front street, Camden, N. J., is an apparatus which provides for lifting crude unscreened sewage with the use of actuating mechanisms or machined surfaces in contact with the material pumped. The operation of the Priestman ejector system is briefly as follows:

Crude unscreened sewage is ejected by compressed air, automatically admitted when the ejector is full, and after a predetermined period being automatically cut off and expanding, while the remainder of the sewage is discharged.

Sewage gravitates into the ejector through a check valve, and in doing so expels the air contents of the ejector through the exhaust pipe to the atmosphere. When the sewage has risen about twelve inches above the mouth of the air bell in the ejector, the pressure of air in this bell, transmitted to the underside of a diaphragm, lifts it about one-eighth of an inch, opening a pilot valve and permitting a small quantity of air to pass from the air-supply main into the motor cylinder. This cylinder, being of larger diameter than the air-admission valve, the motor piston rises, closing the exhaust passageway and then opening a valve, which admits air to the ejector. Air pressure also passes to the upper side of the diaphragm, closing the pilot valve; and the exhaust valve is closed, the air pressure being exerted on the motor piston of that valve. The air is admitted to the ejector for a predetermined interval of time, which is adjusted to afford the highest working efficiency in each installation. The air within the ejector expands and continues to displace the sewage contents until the pressure is reduced to less than that required to hold the exhaust valve to its seat. This valve thereupon opens, permitting the air to exhaust and the ejector to refill.

The system is furnished in capacities ranging from 50 to 2,000 gallons per minute, so that a size may be obtained suitable to any condition, ranging from a small plant suitable for manufacturing concerns who wish to connect to a high-level sewer, to the condition in which a city is obliged to raise the sewage at the point of discharge

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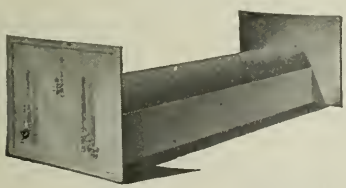
Collapsible Forms for Concrete Culverts.

The Concrete Form and Engine Co., of Detroit, Mich., are manufacturing collapsible culvert forms, which allow an arched

culvert to be constructed without the use of centering, and which may be easily withdrawn after the concrete has set.

These forms are made of 16-gauge galvanized steel covering, reinforced by steel on the inside. They are constructed in three pieces, the top (which is semi-circular) and two side plates. The photograph shows the form, set up complete, with end plates, ready for concrete. The working parts of the form are very simple and easy to operate. The top, set between the two side plates, is held in position by arms attached to the side plates by bolts which allow the arms to be lowered by pulling the draw-rods which are attached to them. By pulling the draw-rods the arms are lowered and the support of the top is removed allowing the top to be lowered. The side plates are held in position by swinging braces, so that when locked the sides are immovable. End plates are made which fasten to the top and side plates by keys so that they may be easily removed.

The first operation in the building of a culvert is the digging of a trench; this, if in hard earth such as clay soil, will not need boarding up, while in sandy soil planking must be used. The trench should be dug at least 4 inches deeper than the water level and this filled with grout and packed down. The width of the trench will depend upon the size of culvert form used and the thickness of the side walls, which we recommend to be eight to ten inches. The forms are then erected in the center of the trench, with the end plates on, and covered with grout. The grout extending to the top of the end plates will give a smooth face at each end of culvert over which the dirt from the roadway will not sift and stop the flow of water. This face



COLLAPSIBLE CULVERT FORM.

or abutment also prevents water from washing around sides of culvert as the face extends 10 or 12 inches beyond the culvert walls.. After the top is drawn the swinging braces are then unlocked and the side plates are easily removed. The culvert will last for years and costs about one-fifth the expense of a culvert constructed in the ordinary way. The forms are furnished for 12, 16 and 18-inch culverts and in 20-foot lengths. The forms are also adaptable to sewer work.

A Portable Asphalt Paving Plant.

A very complete asphalt paving plant, and one which is made for preparing the material "on the job," is being manufactured by the Continental Asphalt and Equipment Company, 1026 First National Bank Building, Chicago, Ill This plant comprises four units; namely, a power wagon for supplying current to the motors which operate the machine, two asphalt melting wagons and a machine for drying the stone and measuring and mixing the composition

The power wagon has a 67-h.p. gasoline engine driving a 45-k.w. electric generator which supplies current for four motors. Each asphalt melting wagon has a tank of 1,400 gallons capacity, heated by steam coils. The blocks of asphalt are laid upon a grating of steam pipes and gradually cut into smaller pieces and melted. Each set of wagons carries a small boiler fired by oil. The tank is fitted with a pump to force the melted asphalt into the measuring tank on the mixer machine for weighing.

The mixer wagon weighs about twelve tons. At the rear of the machine is a bucket elevator, by which the aggregate is delivered to a hopper feeding two sets of driers. Each drier consists of two superimposed revolving drums, fitted with blades. These are 24 inches in diameter and about 7 feet long. The upper drum is inclined 4½ inches in its length, and the material falling from it is delivered by a hood into the end of the lower drum, which has an inclination of 2 inches in its length. The drums are enclosed in a casing and are heated from the outside by means of oil burners. The temperature is about 1,500 degrees F. at the lower drum and 1,000 degrees at the upper drum. The material delivered from the lower drum falls to the boot of a second bucket conveyor, which elevates it to a charging hopper at the top of the machine for weighing; then it is discharged into the hopper below. The material from the drier may be discharged onto the ground, instead of going to the second conveyor, at the will of the operator. Each conveyor has a capacity of about 14 cubic feet per minute.

The two tanks for the dried aggregate and the liquid asphalt are on top of the machine; and proper proportions of the two materials are delivered into hoppers from which they are delivered by a chute and pipe, respectively. to a mixer. This mixer is one of the special features of the machine, the mixing being done in a closed revolving drum. This is, in fact, a concrete mixer adapted to its particular purpose.

This mixing machine has a steel frame work and is mounted on two pairs of wide-tired wheels. It was built by the Koehring Machine Company, of Milwaukee, Wis., according to the design of H. M. Kingsley, president of the Continental Asphalt and Equipment Company, 1026 First National Bank Building, Chicago, Ill.

The Fisher Concrete Block Meets Building Code Requirements.

The departments of public safety and the bureaus of building inspection in a number of cities have adopted regulations governing the use of concrete blocks for building purposes. It is conceded that the concrete block has not been entirely satisfactory as regards strength and imperviousness owing to the methods of manufacture, and at the same time the increased use of the material has made it necessary to place it on a par with brick and other construction materials and provide for its safe use. Baltimore, Md., Philadelphia, Pa., Duluth, Minn., Milwaukee, Wis., Detroit, Mich., and a number of other cities have adopted rules regarding concrete blocks and have incorporated these regulations in their building codes.

Detroit has recently enforced its code by testing the blocks manufactured in that city to determine the quality of the product that was being used. The Fireproofing Tile Company's concrete blocks were the only ones that could meet the tests required by the new code of the city. The Detroit Fireproofing Tile Co. are using a Fisher hydraulic ramming concrete machine and are operating the same to manufacture products such as dimension stone, trimmings, blocks, etc.

Official tests were made by the Detroit testing laboratory and these tests showed a crushing strength upward of 2000 lbs. to the square inch on an area of 9 inches and an absorption of less than 4 per cent.

Milwaukee has adopted a new ordinance for the use of concrete blocks in that city. The Roman Stone Co. of Milwaukee, after a careful investigation, conferring with the different manufacturers and users of machinery decided that only by the use of a wet mixing and ramming could a perfect concrete be produced, and are now installing one of the hydraulic ramming outfits purchased from the Fisher Hydraulic Stone and Machinery Company, 1109 Kilburn Ave., Rockford, Illinois.

An Automatic Dump Cart for Street Cleaning.

The Baker Manufacturing Company, 570 Hunter Building, Chicago, Ill., has a new type of light dump cart which is particularly adapted to street cleaning work. This cart, known as "The Witten," is of all-steel construction, making it very light and durable. The cart box is 2 feet by 4 feet by 16 inches deep, and is mounted upon the axle in such a manner as to balance the load evenly. In this way the weight of the load is not thrown upon the handles; and a fully-loaded cart may be propelled with as little effort as an empty wheelbarrow.

A simple releasing lock is provided, whereby the box is held firmly in position; but may be released and the contents dumped from the forward end of the cart without the workman leaving his position at the handles of the cart. This is provided by a system of levers connected with the end-gate at the forward end in such a manner that this end-gate rises as the box tilts forward, allowing the contents of the cart to be deposited upon the ground. By reason of its ease of operation the new dump cart is particularly adapted to street department work.

"Corinthian" Standards Chosen by the Government.

James Knox Taylor, Supervising Architect for the United States government has announced the selection of lamp standards and brackets in iron and bronze for various public works. The Flour City Ornamental Iron Works of Minneapolis, Minn., the manufacturers of the "Corinthian" ornamental lighting standard, were chosen out of eight competitors as complying with the specifications.

Trade Publications.

Voightman & Co., 445 West Erie street, Chicago, Ill., have a complete and fully illustrated booklet showing their line of metal windows. Line drawings, sections and photographs show the different types of windows and their methods of operation. Full directions are given regarding the installation of the metal panes according to underwriter's specifications.

"Storage Battery Cars" is the title of Bulletin No. 13, just issued by the Gould Storage Battery Company, 341 Fifth avenue, New York. This bulletin explains the economics of the storage battery car, describes the standard type made by the Gould Company and cites the conditions under which storage battery cars can be used most profitably. A copy will be sent on request.

The monthly publication of the Universal Portland Cement Company, Chicago, Ill., contains examples of concrete pavements, the Ashokan reservoir and road improvements, and some examples of concrete arch bridge and building construction.

Selling arguments for tin roofing are set forth in an illustrated booklet by the N. & G. Taylor Company, Philadelphia, Pa. It contains tables for estimating, instructions for laying and a description of the manufacture of roofing tin.

The "Kanawha" air pressure chemical fire apparatus is fully described in a booklet issued by the Kanawha Chemical Fire Engine Manufacturing Company, 74 Cortlandt street, New York, N. Y. The apparatus described makes use of a compressed air device for distributing a chemical solution.

Bulletin No. 36 of the Bates Machine Company, Joliet, Ill., describes and illustrates the new Bates inertia valve gear, which is now regularly applied to all Bates Corliss engines. This new gear has attracted much attention because of its quiet operation and the absence of hooks, springs and rollers.

The Bausch & Lomb Optical Company, Rochester, N. Y., has a very complete catalogue, descriptive of projection apparatus. This catalogue contains, besides interesting tables and data for reference purposes, a complete line of "Balopticons," or lanterns, by means of which photographs and natural objects may be projected upon a screen without first making lantern slides.

A short description and a very unique and interesting graphic outline serve to show the method of manufacturing Universal Portland cement. A booklet containing this matter may be obtained by requesting it from the Chicago office of the Universal Portland Cement Company.

The Warren Brothers Company, 59 Temple Place, Boston, Mass., has for distribution three interesting publications. The first of these, "Asphalt," by George C. Warren, deals with the origin and development of asphalt and gives some analysis for comparison of the different asphalts. The other two deal with asphalt paving plants; the one giving a full description of the larger or stationary plants, while the other treats of a portable asphalt and repair plant. Both are fully illustrated.

The Baker Manufacturing Company, 256 Madison street, Chicago, Ill., has a catalogue describing their "Twentieth Century" grader. The grader is particularly adapted to road improvement and maintenance, snow removal, pavement cleaning, and to the cutting of shallow ditches.

The William E. Dee Company, 108 North LaSalle street, Chicago, Ill., has a number of folders and leaflets which illustrate and describe the supplies manufactured and sold by that company. These include sewer pipe and specials, drain tile, cement coatings and waterproofings, cement, fire clay products and a full line of municipal castings.

A. Wyckoff & Son Company, Elmira, N. Y., has for distribution a reprint of a paper by T. Chalkley Hatton before the American Water Works Association, in Rochester, on June 7, 1911. The paper deals with wood stave pipe.

A direct connected Corliss engine and two types of direct current motors and generators are described in three new publications of the Allis-Chalmers Company, Milwaukee, Wis. These three bulletins, as is usual of the publications of the Allis-Chalmers Company, are complete in detail and fully illustrated.

The monthly bulletin of the Lehigh Portland Cement Company, Peoples Gas Building, Chicago, Ill., contains a short description, with photographs, of concrete bridge work on the A. C. L. railroad, the longest concrete highway bridge in the world, at Harrisburg, Pa., and a number of photographs of building work.

The American La France Motor Car Company, Elmira, N. Y., has an interesting collection of facsimiles of letters and newspaper comment on their motor fire apparatus.

The Terry Steam Turbine Company, 90 West street, New York City, has a bulletin describing its new non-condensing steam turbine and its applications.

Trade Notes.

Washington, D. C.—A correspondent in India desires one traction engine with sufficient power to drag 30 to 40 tons on level roads, 9 trucks of 10 tons capacity, one 10-ton steam road roller and a diagram of a pumping plant for wells, using gasoline and kerosene engines. Address Bureau of Manufactures, No. 7435.

Washington, D. C.—A report from an American consulate in Mexico states that a city is contemplating the purchase of street sweeping machines. Address Bureau of Manufactures, No. 7472.

Atlanta, Ga.—The MacArthur Concrete Pile and Foundation Company has been awarded a contract for the foundations of Fulton county court house, Atlanta, Ga. This building is to be a 9-story reinforced concrete structure, and is to cost in the neighborhood of $750,000. W. C. Spiker is consulting engineer.

Kankakee, Ill.—J. E. Pickens desires to purchase 2,400 feet of 8-inch and 6-inch pipe.

Hartford City, Ind.—The county commissioners are contemplating the purchase of a smoke consumer for the court house and jail.

New Orleans, La.—Bids will be received on December 7, at 3 p. m., for power equipment as follows: One 6,000-kw. horizontal high-pressure condensing steam turbine and alternating current generator, one 150-kw. rotary converter with stationary transformers, one 7-panel switch board. Certified check, $500. F. S. Shields, secretary; George G. Earl, general superintendent.

Buffalo, N. Y.—Special.—The Corrugated Bar Company has announced the removal of its headquarters from St. Louis, Mo., to Buffalo, N. Y., to occur on the fourteenth of this month. The company will occupy the third and fourth floors of the Mutual Life Building in Buffalo. The change in headquarters has been decided upon, as the stock warehouse and fabricating plants are located near Buffalo. District offices will be maintained in the National Bank of Commerce Building at St. Louis, as well as in New York and Chicago.

Elyria, O.—The city desires catalogues and information on sewer cleaning machines. Martin Muller, director of public service; Thomas A. Conway, mayor; Rhose Morarity, clerk.

Union, S. C.—Special.—The Municipal Electric Light and Water Works has recently made extensive improvements at its plant. A 75-kw., 3-phase, 60-cycle, 2,300-volt generator, direct connected to a 135-h.p. Harrisburg engine, with necessary switchboards, has been added to the plant. R. A. Easterling is superintendent.

Nashville, Tenn.—Special.—One of the most up-to-date, modern stone-crushing plants has been erected by the Southern Bitulithic Company at Woodstock, Ala. This enterprise represents an investment of about $100,000. Machinery has been installed for the special purpose of crushing, separating and delivering to contractors any particular size stone they may need. We understand the company will also make a specialty of furnishrip-rap or rubble stone. Headquarters of the Southern Bitulithic Company are located at 602 First National Bank Building, Nashville, Tenn.

Spokane, Wash.—City engineer Macartney has recommended the purchase of a steam shovel, to cost about $4,000.

Lethbridge, Alberta, Can.—Bids will be received on November 24 for power house equipment, as follows: Section B, boilers and accessories; section C, mechanical draft and economizer; section D, steam turbo-generator set and condensing equipment; section E, steam-engine-driven exciter; section G, substation equipment. Certified check, 10 per cent. E. W. Robinson, secretary.

Patents on Road and Pavement Construction and Repair.

867,852. Device for Laying Concrete Pavements. Geo. W. and Geo. F. Switzer, Salisbury, N. C.

875,288. Manufacture of Bituminous Concrete. Jas. L. Rake, Reading, Pa., and Clifford Richardson, New York, N. Y.

881,669. Wheeled Scraper. Norman S. Dunaway, Pelham, Ala.

887,188. Process of Producing Road Metal (from slag). John F. Burn, Detroit, Mich.

890,328. Anticreeper for Rails. Adolphus Bonzano, Philadelphia, Pa.

894,346. Rolling Tamper. Geo. Ross and Stephen F. Deal, Kansas City, Mo.

900,626. Scraper. Wm. P. Warren, Sheridan, Ill.

900,729. Wood Block Paving. Wm. H. Harvey, Vancouver, B. C., Can.

905,190. Machine for Surfacing Roads, Pavements, Etc. Colin M. Ingersoll, New York, N. Y.

905,367. Road Grading Machine. John Rein, Whalan, Minn.

905,904. Road Grader and Scraper. Richard D. Moon and Geo. N. Chamberlain, San Angelo, Tex.

908,078. Road Scraper. John M. Dobey, Timewell, Ill.

909,228. Riding-Wheel Road Scraper. Sylvester Robinson and James A. Saffer, Emporia, Kan.

909,499. Road Construction. Fred'k. F. Williamson and Daniel Brennan, Jr., New York, N. Y.

909,966. Road Drag. Wm. A. Traver, Weedsport, N. Y.

910,025. Wheeled Scraper. Thos. H. Stagg and John Anthony, Columbus, O.

910,384. Road Grader. Lew Ireland, Fredericktown, Ohio.

910,568. Pavement and Method of Constructing the Same (of concrete in street car tracks). Jas. A. Omberg, Memphis, Tenn.

910,636. Machine for the Formation of Coverings on Streets, Roads and Other Places. John E. Behmer, Eskilstuna, Sweden.

910,705. Street Crossing. (Protected and reinforced concrete.) Simon B. Minnich, Landisville, Pa.

910,836. Ditcher and Road Grader. John D. Martin, Reynolds Sta., Ky.

910,922. Process of Removing Asphalt Pavement. Wm. E. Kerns, Fox Chase, Pa.

910,928. Adjustable Road Grader. John H. Koontz, Indian Creek tp., Monroe Co., Ind.

911,445. Composition Roadway. Benj. F. Richardson, Philadelphia, Pa.

912,126. Pavement. Walter E. Hassam, Worcester, Mass.

912,478. Surface Street or Road Railway for Automobiles and Other Vehicles. Madison Maquinn, Chicago, Ill.

912,898. Street Pavement or Roadway. August E. Schutte, Boston, Mass.

913,686. Method and Apparatus for Atomizing and Spraying Oily Materials. Heinrich O. Brandt, Manchester, Eng.

913,788. Snow Road Machine. John Warcup, Lemesurier, Quebec, Can.

914,241. Road Working Machine. Alonzo C. Callender, Port Gibson, Miss.

914,603. Paving Rammer. Niels C. Ovist and Wilhelm H. Nordstroem, Horsens, Denmark.

914,610. Wheeled Scraper. Allen H. and Luther L. Smith, Herman, Neb.

915,062. Road and Method of Building Same. Amzi L. Barber, Washington, D. C.

915,492. Road Machine. Marion M. Sickler, Buffalo, N. Y.

916,070. Pavement. Walter B. Warren, Newton, Mass.

916,179. Road Drag. Edward J. Mills, Webb, Iowa.

916,199. Road Grader or Scraper. Samuel Richardson, Hoover, Ind.

916,676. Apparatus for Cutting Road Beds. Lee D. Craig, San Francisco, Cal.

916,693. Pavement (concrete block). Wm. H. Fulcher, Oakland, Cal.

917,279. Road Grader and Scraper. Benj. A. Fleshman, Wyaconda, Mo.

917,528. Road Scraper. Jos. T. Bland, Pittsboro, N. C.

917,977. Road Grader. Sam'l. A. Ulrich, Mendota, Mo.

918,156. Road Construction and Art of Making Same. Frank S. Hutchinson, Flushing, N. Y.

918,490. Method of Forming Surfaces on Roads. Thos Aitken, Cupar-Fife, Scotland.

918,633. Grading Machine. Carl O. Wold, Minneapolis, Minn.

918,980. Wire Cut Brick. Frank B. Dunn, Conneaut, O.

918,993. Road Float. Franklin L. Gaines, Grand Rapids, Mich.

919,428. Flexible Road Drag. Ozro H. Gillespie, Madison, Neb.

919,530. Pavement. Rudolph S. Blome and Wm. J. Sinek, Chicago, Ill.

920,422. Road Drag. David C. Boyd, Galion, O.

920,807, 920,808. Paving Blocks. Edward Alcott, Pittsburg, Pa.

921,223. Road Crossing. Lott Frederick, Indiana, Pa.

922,493. Road-Grading Attachment for Vehicles. Winfield S. Livengood, Kansas City, Mo.

922,687, 922,688. Street Pavement. Samuel E. Finley, Atlanta, Ga.

923,195. Construction of Roadways, Footways and the Like. Geo. A., Arthur J. and Ernest E. Mitchell, London, Eng.

923,421. Asphalt Heater. Jas. F. Driscoll, and Harry Thompson, St. Louis, Mo.

923,891. Manufacture of Bituminous Roadways. Clifford Richardson, New York, N. Y.

924,086. Road Surface Preparation or Composition. Wm. A. and Sydney C. Meadows, Liverpool, Eng.

924,311. Road Drag. David C. Boyd, Galion, O.

924,810. Road Scraper. John A. Miller, Rosebud, Mo.

924,966. Road Grading Machine. Harry K. Clemons, St. Paul, Minn.

925,035. Wheeled Scraper. Chas. H. Sawyer, Minneapolis, Minn.

925,714. Road Roller. Josiah V. Miller, Judge, Mich.

926,062. Paving Block. Wm. Hanley, Bradford, Ind.

926,443. Apparatus for Laying Concrete Road Beds. Frank M. Talbot, Glenridge, N. J.

926,503. Road Grader and Ditching Machine. John M. Mock and Hollie C. Prather, Jewett, Ill.

927,239. Road Repairing Machine. W. G. Herring, Comanche, Tex.

927,315. Apparatus for Spreading Liquid Asphalt. Chas. A. Baldwin, Los Angeles, Cal.

927,887. Road Machine, Marion N. Sickler, Pala, Cal.

928,205. Road Grader. Winfield S. Livengood, Kansas City, Mo.

928,488. Pavement Cutter. Daniel E. Wiseman, San Francisco, Cal., and Fred F. Hedden, Chicago, Ill.

929,210. Street Paving Brick. Frank W. Grebe, Phillipsburg, Pa.

929,366. Pavement. Edward Alcott, New York, N. Y.
929,699. Rroad Scraper. James H. Osten, White City, Kan.
930,153. Paving Block. Samuel Butz, Easton, Pa.
930,161. Road Locking Block. Henry H. Dickson, Orlando, Fla.
931,085. Machinery for Heating and Rolling Bituminous Pavements. Chas. F. Prescott and Wm. E. Kerns, Philadelphia, Pa.
932,116. Road Oiler. Wm. H. Gailor, Saratoga Springs, N. Y.
932,941. Method of Making and Laying Paving Composition. Joseph H. Amies, Philadelphia, Pa.
933,521. Paving Block. David Atherton, Phillipsburg, Pa.
933,803. Apparatus for Making Tar Paving. James Ward, Grange,over-Sands, England.
934,030. Sheet-Wood Paving. Joseph H. Amies, Philadelphia, Pa.
934,071. Road Scraper. Edda G. Hartle, Columbus, O.
934,494, 934,495. Paving Compositions. Joseph H. Amies, Philadelphia, Pa.
934,630. Road Machine. Fred N. Root, Kalamazoo, Mich.
935,572, 935,573. Composition for Binding, Surfacing and Resurfacing Purposes in Street and Road Building, and Bituminous Cement. Jos. H. Amies, Philadelphia, Pa.
936,493. Pavement and Process for Making the Same. Jas. C. Travilla, St. Louis, Mo.
936,716. Road Oiler. Chas. M. Haeske, South Bend, Ind.
937,216. Road Scraper. Claude D. Kinsman, Lincoln, Neb.
937,660. Sprinkling Machine (for hot oil on roads). Ellis Tomer, Visalia, Cal.
937,822. Vitrified Paving Brick. Karl Langerbeck, Boston, Mass.
13,024 (reissue). Process for Preventing and Laying of Dust Through the Application to Roads or Road Material of an Aqueous Emulsion of Oil. Wm. M. Sandison, Ashfield, Ayton, Scotland.
938,249. Road Machine. Mathias Lampl, Iwissvale, Pa.
938,698. Method of Rejuvenating Asphalt. Jas. A. W. Pine, New York, N. Y.
938,003. Road Grader and Drag. Elmer B. Fritchman, Humansville, Mo.
939,664, 939,665. Road Scrapers. Cyrus H. Casner, Hepburnville, Pa.
939,877. Road Roller. Marquis J. Todd and David Farquhar, Buffalo, N. Y.
940,169. Road Making Machine. Elias L. Lathrop, Galion, O.
940,389. Road Grader. Arnold W. Hadley and Harvey M. Smith, Monroe tp., Morgan co., Ind.
940,432. Nosing for Curb Corners. Wm. S. Clifford, New York, N. Y.
940,666. Scraper. Harvey Bingaman and John A. Miller, Harding, S. D.
940,971. Method of Road Construction and Repair. Solon G. Howe, Detroit, Mich.
941,548. Road and Street Construction. Joseph H. Amies, Philadelphia, Pa.
941,886. Process of Laying Concrete Pavements. Franklin S. Lamson, Washington, D. C.
942,235. Method of Preparing Mineral Materials and the Like for Street and Road Construction. Jos. H. Amies, Philadelphia, Pa.
942,236, 942,237. Compositions for Paving Purposes. Jos. H. Amies, Philadelphia, Pa.
942,749. Road Grader and Scraper. Saml. Richardson, Hoover, Ind.
942,866. Road Working Machine. Michael A. Popkess, Kansas City, Mo.
13,055 (reissue). Apparatus for Cutting Roadbeds. Lee D. Craig, San Francisco, Cal.
943,667. Composition for Laying Road Dust and Hardening Road Beds. Carleton Ellis, Larchmont, N. Y.
943,864. Wheel Mounted Scraper. Lewis C. Fasig, Ashland, O.
944,652. Pavement. Wm. H. Baker, Sugar Creek, O.
945,088. Road Scraper. Stanley Griffin, Elyria, O.
945,179. Road Grader. Winfield S. Livengood, Kansas City, Mo.
945,312. Curbing (with internal conduit). Joseph Firth, Charlotte, N. C.
945,560. Machine for Making Roads. Alvin O. Lombard, Waterville, Me.
945,999. Road Construction. Joseph H. Amies, Philadelphia, Pa.
946,063. Road Grader. Frank A. Mattson, Cumberland, Wis.
946,187. Road Working Machine. Edward B. Winters, Coffeyville, Kan.
946,925. Road Drag. Walter S. Walker, Helena, Mo.
947,707. Road Scraper. Thos. and Albert A. Addison, Covington, Tenn.
948,720. Road Drag. Elbert L. Carroll and Robert M. Skiles, Creston, Iowa.
949,117. Road Machine. Jas. A. Ferguson, Cambridge, Mass.
949,588. Road Grader. Joseph P. Lutes, Buffalo, N. Y.
950,171. Road Scraper. John M. Harrington, Edgerton Jc., Mo.
950,457. Road Working Machine. John M. Parcel, Jr., Mendota, Mo.
950,541. Asphalt Expansion Joint. Cristopher S. McGinn, St. Louis, Mo.
952,338. Road Smoothing Device. Frederick W. Lechner, Wenona, Ill.
952,395. Road Grading Machine. Bennie Whittemore. Albert Lea, Minn.
952,882. Concrete Paving Machine. Reed Deeds, Cuyahoga Falls, O.
953,085. Road Grading Machine. Butler F. Elliott, Gotebo and Jacob L. Simmers, Ft. Cobb, Okla.
953,406. Road Grader. Wm. H. Beam, Purcell, Okla.
953,490. Street Gage. Patrick Roughen, Fond du Lac, Wis.
954,386. Road Grader. Adam Granser, Lodi, Wis.
954,692, 954,693, 954,694. Composition of Matter for Concrete, Building Brick and Road or Street Brick. Henry D. Phillips, Indianapolis, Ind.
954,966. Tread Surface for Pavements and the Like. Chas. B. Jacobs, Port Chester, N. Y.
13,101 (reissue). Road Grading Machine. Parley I. Jewett, Butler, Mo.
956,009. Method of Making Roads. Leonard S. von Westrum, Grand Rapids, Mich.
956,744. Road Grader. Henry Sunderman, Madison, Neb.
956,940. Oiled Concrete Roadway. Edward M. Chadbourne, San Francisco, Cal.
957,357. Road Grader. Thos. E. Lyon, Bucklin, Kan.
957,985. Process of Making Pavements. J. Y. McClintock, Rochester, N. Y.
958,063, 958,064. Street and Rural Constructions. Joseph H. Amies, Philadelphia, Pa.
958,346. Road Roller. Fredk. F. Williamson and Daniel Brennan, Jr., New York, N. Y.
958,891. Road Grader and Scraper. Frank L. Reising, Pipe City, Ill.
959,668. Road Scraper. Henry Wiechelman, Long Pine, Neb.
959,976. Composite Pavement. Edwin C. Wallace, East Auburn, Cal.
960,296. Road Grader and Ditcher. Jesse P. Evans and Julius B. West, Barton, Ark.
961,007. Road Drag and Grader. Orlando F. Phillips and Martin H. McCaulon, Butlerville, Ind.
962,150. Pavement. Harry G. Jennison, Toledo, O.
962,209. Road Oiler. Wm. H. Gailor, Saratoga Springs, N. Y.

(To be Continued.)

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Pensacola, Fla.—Nov. 14, 12 m. Paving construction as follows: 180,000 sq. yds. of clay or shale block, sheet asphalt, asphalt block, bitulithic, wood block or concrete pavement, and 116,000 lin. ft. of concrete curb. Certified check, $5,000. John A. Merritt, chairman board of bond trustees; George Rommel, Jr., engineer.

Monmouth, Ill.—Nov. 15. Constructing 9,300 sq. yds. and 5,400 sq. yds. of brick pavement on gravel base. R. M. Ferguson, city engineer.

Brazil, Ind.—Nov. 10, 11:30 a. m. Constructing one gravel road in Posey township. Edward A. Staggs, auditor.

Brownstown, Ind.—Nov. 6, 1:30 p. m. Constructing two roads. H. W. Wacker, auditor.

Decatur, Ind.—Nov. 6, 10 a. m. Constructing macadamized road in Jefferson township. H. F. Michaud, auditor.

English, Ind.—Nov. 6, 2 p. m. Constructing three miles of pike road. J. Evans Jones, auditor.

Fowler, Ind.—Nov. 6, 1 p. m. Constructing a stone road in York township. Lemuel Shipman, auditor.

Indianapolis, Ind.—Nov. 3, 2 p. m. Constructing gravel road on line between Franklin and Perry townships. Albert Sahm, auditor.

Jasper, Ind.—Nov. 6. Constructing rock road 2½ miles long in Columbia township. M. A. Sweeney, engineer.

Logansport, Ind.—Nov. 7, 10 a. m. Constructing one gravel road and one macadam road. J. E. Wallace, auditor.

Peru, Ind.—Nov. 9, 12 m. Constructing three roads. Fred J.. McElheny, auditor.

Rensselaer, Ind.—Nov. 6, 2 p. m. Constructing five miles of stone road. James N. Leatherman, auditor.

Washington, Ind.—Nov. 7, 10 a. m. Constructing one gravel road. Thomas Nugent. auditor.

Winamac, Ind.—Nov. 7, 12 m. Constructing two highways. W. E. Munchenburg, auditor.

Cincinnati, O.—Nov. 3, 12 m. Constructing Forfeit Run road under specification number 258. Bond, $2,000. Fred Dreihs, clerk, board of Hamilton county commissioners.

Cleveland, O.—Nov. 15, 11 a. m. Improving Fairmount road. Certified check, $1,000. John F. Goldenbogen, clerk.

Cleveland Heights, O.—Nov. 7, 12 m. Improving Highland road with brick, asphalt or macadam, and constructing sidewalks. Certified check, 10 per cent. H. H. Canfield, clerk; The S. A. Pease Engineering Company, 931 Williamson building, Cleveland, O., engineers.

Pleasant Ridge, O.—Nov. 7, 12 m. Improving Kincaid road with macadam. Certified check, $250. H. B. Hayden, city clerk.

Newport, R. I.—Nov. 4, 11 a. m. Constructing vitrified brick paving at U. S. Naval Torpedo Station, Newport. R. C. Hollyday, chief of bureau of yards and docks, Washington, D. C.

CONTRACTS AWARDED.

Birmingham, Ala.—The following paving contracts have been awarded: Macadam on Thirteenth street, to the Southern Asphalt Co., $3,254; macadam on Ensley, to the same, $15,031; Third avenue, to Paul Richter, $1,408.

Los Angeles, Cal.—Improving 4.16 miles of road, to John W. Polcaro, $36,728.

Marysville, Cal.—Constructing bridge over Grasshopper slough, to F. E. Froh and Sons, $1,500.

Santa Monica, Cal.—Improving Seventh street, to Fred H. Stout, Bradbury building, Los Angeles, Cal., about $30,000.

San Francisco, Cal.—Constructing asphalt pavement, to the City Street Improvement Co., San Francisco, Cal.

Denver, Colo.—Paving West Twenty-third street with asphalt, to the Denver and Pueblo Construction Co., Denver, Colo., $21,771.

Hartford, Conn.—Constructing macadam road, to F. Arrigoni & Bro., Middletown, Conn.

Norwalk, Conn.—Constructing macadam roads, to Jno. A. McElroy.

Dover, Del.—Paving the Woodland Beach boulevard, to James R. Mott, $10,850.

Wilmington, Del.—Paving construction, to Harrigan Construction Co., Wilmington, Del., $29,750.

Freeport, Ill.—Constructing macadam on Jefferson street, to the Gund Graham Co., Freeport, Ill., $18,367.

Joliet, Ill.—Paving Jefferson street with asphalt, to R. F.. Conway & Co., 133 West Washington street, Chicago, $12,695.

Park Ridge, Ill.—Constructing sewer and paving East Center street, to Cleary, White & Newman, $59,477.

Peoria, Ill.—Paving Liberty street with creosoted wood blocks, to J. W. Bushel, $11,084.

Newport, Ind.—The following road contracts have been awarded: The Deck road, to Kester Bros., $3,098; Hillsdale road, to Ingram & Co., $9,946; Range Line road, to Geo. W. Sykes, $7,845.

Coffeyville, Kan.—Paving West Third street, to McQuire and Stanton, $28,516.

Louisville, Ky.—Paving Broadway with asphalt, to the Barber Asphalt Co., $23,200.

Ashburnham, Mass.—Constructing state highway, to F. G. Magne, West Newton, $7,831.

Boston, Mass.—The following paving contracts have been awarded: Tar macadam in Fottler road, to William J. Rafferty, $3,776; tar macadam in Hiawatha road, to James Dougherty, $6,070; tar macadam in Dorris street, to Fred S. & A. D. Gore Co., $1,007; tar macadam in Bradfield Ave., to the West Roxbury Trap Rock Co., $9,048.

Boston, Mass.—Constructing macadam roadway, to the Rowe Contracting Co., Boston, Mass., $12,592.

Hardwick, Mass.—Constructing state roads, to Charles E. Horn, of Millbury, Mass., $11,000.

Minneapolis, Minn.—Constructing eight miles of Superior boulevard, to James O'Neill and Company, $33,675.

St. Joseph, Mo.—Paving Messinia street,

to the Young Bros. Construction Co., St. Joseph.

Jackson, Miss.—Paving West Capitol street, to the Southern Asphalt Paving Co., of Birmingham, Ala., $30,000.

Newark, N. J.—Paving Sixteenth avenue, to the Newark Paving Co., $10,736.

Rahway, N. J.—Paving Main street, to the Jersey Paving Corporation, of Newark, N. J., $24,000.

Toms River, N. J.—Constructing six miles of road, to John L. Le Compt, of Lakewood, N. J., $29,950; constructing five miles of road, to S. T. and L. W. Holman, of Whitesville, N. J., $18,976.

Schenectady, N. Y.—Constructing bitulithic paving, to the Warren Bros Co., of Boston, Mass., $42,397.

White Plains, N. Y.—Paving construction as follows: Orawaupum street, to E. L. Erbach; Walworth avenue, to Benjamin Ora; mo; Lake street, to the Connecticut Hassam Paving Co.

Yonkers, N. Y.—The following paving contracts have been awarded: Fairview avenue, to Charleton & Weston, 90 Asig street, $6,495; grading Frederick street, $15,890, grading Marlborough avenue, $4,220, grading Palmetto street, $6,490, grading New avenue, $17,478, all to Charleton & Weston; grading Murray avenue, $44,500, to Thomas Grady, 11 Myrtle street; grading Armstrong avenue, to Fred E. Gross & Son, 819 Nepperham avenue, $2,300.

Yonkers, N. Y.—The following street improvement contracts have been let: Springer avenue, to Joseph L. Puozzo, 176 Oak street, $10,975; Alexander avenue, to Joseph L. Puozzo, $5,371; Glover avenue, to Kelly & Hanifin, 763 Palisade avenue, $5,728.

Ashland, O.—Improving the Sullivan Southern road, to D. A. Phillips, Ashland, O., $5,820; improving the Sullivan Wellington road, to same, $8,600.

Bryan, O.—Macadamizing 1.52 miles of road in Pulaski township, to Fishbaugh, Karch and Appenzeller, Greenville, O., $11,841.

Caldwell, O.—Paving North and Miller street with brick, to Wilson and Harper, of Barnesville, O., $11,000.

Caldwell, O.—Paving New street, to Wilson & Harber, of Barnesville, O., about $11,000.

Cincinnati, O.—The following road contracts have been awarded: Tanner avenue, to John Nickoson, $10,205; improving of Burnt School House road, to O. E. Robinson, $5,234.

Cincinnati, O.—Improving Shawnee road, to Frank Hosbrook, of Blue Ash, O., $6,236.

Massillon, O.—Paving North Mill street, to A. F. Wendling, of Massillon, $10,186.

Medina, O.—The Kennedy Warner Co. has been awarded the contract for one mile of macadamized road, $9,000.

Palestine, O.—Paving 5,600 feet of the Elkton road, to Geo. B. Patterson, of Wellsville, O., $13,172.

Springfield, O.—Constructing road, to Walker & Scott, Cincinnati, O., $52,000.

Nowatta, Okla.—Constructing asphalt pavement, to the Southwestern Engineering and Construction Co., $52,935.

Tulsa, Okla.—The following paving contracts have been awarded: Sheet asphalt, to the Eureka Construction Company, Houston, Tex., $200,000; Trinidad sheet asphalt, to the Cleveland Trinidad Company, $26,000; brick alley, to the Parker Washington Construction Company, $4,000.

Medford, Ore.—Paving Third street, to Clark-Henery Co.

Pendleton, Ore.—Paving Webb and Alba streets, to the Warren Construction Co., Portland, Ore., $40,000.

Portland, Ore.—Paving Twenty-sixth street, to the Star Sand Co., Portland, $24,480.

Cannonsburg, Pa.—Paving South Central avenue, to Maynard & Flynn, of Pittsburg, Pa.

Carbondale, Pa.—Paving Pike street, to John Booth, of Carbondale.

Dorrancetown, Pa.—Paving Butler street, to U. S. Wood Preserving Co., 165 Broadway, New York, $8,256.

Du Bois, Pa.—Paving North Main street, to Hatten & Co.

Erie, Pa.—Paving Ash street, to Mayer Bros. Construction Co.

Harrisburg, Pa.—Constructing 5,048 feet of road, to The Juniata Paving Co., of Philadelphia, Pa., $13,225.

Masontown, Pa.—Paving West Church street, to the Uniontown Construction Co., of Uniontown, Pa.

McKees Rocks, Pa.—Constructing bridge at Island avenue, to the Des Moines Bridge Co., of Des Moines, Ia., $19,800.

Mt. Pleasant, Pa.—Paving a number of streets with brick, to Maynard & Co., of Pittsburg Pa., $14,020.

Pittsburg, Pa.—Grading, paving and curbing a number of streets, to James H. McQuaide Co., $13,715.

Pittsburg, Pa.—Paving 0.9 miles, to Thomas Cronin & Co., South Seventeenth street.

Pittsburg, Pa.—Widening Smithfield bridge, to John F. Pasey, $81,532.

Uniontown, Pa.—Constructing road, to Reed & Patton, of Curwensville, Pa., $67,000.

Huntington, Tenn.—Constructing concrete sidewalk, to the Monroe Construction Co., of Humboldt, Tenn.

Knoxville, Tenn.—Paving Baxter avenue, to the Barber Asphalt Paving Company.

Greenville, Tex.—Constructing five blocks of pavement, to the Texas Bitulithic Co., of Dallas, Tex.

Hamlin, Tex.—Constructing 20,000 sq. yds. of pavement, to Ray McDonald, of Marlin, Tex., $40,000.

Galveston, Tex.—Constructing brick roadway for arched bridge and mud-shell road, to J. P. Kelso, $24,300.

Colfax, Wash.—Constructing three miles of road, to the Wilson-Bailey, North Yakima, Wash., $23,270.

Seattle, Wash.—Paving First avenue, to Sloan Bros, 1013 East John street, $47,620; California avenue, to J. A. McEachern Co., $2,395; alley in Capital Hill addition, to Sanfield & Richie, 1233 Thirteenth avenue, North, $3,973.

Seattle, Wash.—The following street improvement contracts have been awarded: Prince avenue, to Sloane Bros., Forty-second avenue, South, $47,620; alley in block 37, to Sanfield and Richie, 1241 Eighteenth avenue, West, $3,973; Twenty-fifth avenue, West, to Hanson & Co., 4100 Twenty-fifth avenue, Southwest, $3,720; California avenue, to Hanson & Co., 4100 Twenty-fifth avenue, Southwest, $2,087; Twenty-second avenue, Northeast, to Andrew Peterson & Co., Montera, Wash, $28,401; Twenty-third avenue, West, to J. A. McEachern, Bailey building, Seattle, $5,993.

Spokane, Wash.—Grading Lacey street, to Naylor and Norlin, $2,889.

Vancouver, Wash.—Paving Twenty-sixth street with Tarvia, to the Star Sand Co., $24,800.

Morgantown, W. Va.—Paving Pine street, to Arthur M. Lucas & Co.

Wheeling, W. Va.—Paving Edgington Lane, to Springer and Stringer.

Ottawa, Ont.—Paving York street, to the Union Construction Co., of Ottawa, $23,739.

CONTEMPLATED WORK.

Montgomery, Ala.—The city is contemplating paving improvements to cost about $100,000

Ft. Smith, Ark.—The city is contemplat-

ing the repaving of Garrison avenue, to cost about $30,000.

Indianapolis, Ind.—Brightwood is contemplating paving of several streets with asphalt or brick.

Coeur d'Alene, Ida.—The city is contemplating street paving to cost $36,000.

Franklin, Ky.—A $70,000 bond issue for road improvements has been voted.

Detroit, Mich.—The committee on parks and boulevards has recommended the use of cheap asphalt on all boulevard construction.

Biwabik, Minn.—The city is contemplating the construction of curbs and gutters to cost $9,000.

Dundee, N. Y.—The village is contemplating the paving of Union and Seneca streets, to cost about $7,000.

Laurinberg, N. C.—A $30,000 bond issue for road construction has been voted. D. Z. Hardin, commissioner.

Columbus, O.—James R. Marker, state highway commissioner, has recommended an increased bond issue for road construction.

Pryor Creek, Okla.—The Benham Engineering Co., 812 American National Bank building, Oklahoma City, Okla., are preparing plans for eight blocks of pavement in the business district.

Hillsboro, Ore.—City is contemplating sewer construction to cost about $100,000.

Jacksonville, Ore.—A $1,500,000 bond issue has been voted for construction of roads in the county.

New Brighton, Pa.—The paving of Fifteenth street in Patterson Heights is contemplated.

Newcastle, Pa.—The city is contemplating the construction of a municipal light plant, sewage disposal plant and general street improvements.

Dallas, Tex.—The city is contemplating the paving of twelve miles of streets.

El Paso, Tex.—City is contemplating the construction of asphalt macadam pavement on fourteen blocks of Arizona street.

Louden, Tenn.—A $25,000 bond issue for road improvements has been voted.

Richmond, Va.—The city is contemplating the paving of a number of streets and the repaving of Broad street.

Kennewick, Wash.—Bids will be received about Nov. 15th for $54,000 worth of concrete sidewalks and curbs.

Omak, Wash.—A $4,000 bond issue for street improvements has been voted.

Pomeroy, Wash.—The county is contemplating the purchase of a motor road roller to cost $3,500.

SEWERS.

BIDS REQUESTED.

Texarkana, Ark.—Nov. 11, 1 p. m. Constructing 2,000 cu. yds. of levee, together with drainage ditches. Certified check, 25 per cent. Morgan Engineering Co., 610 Goodwyn Institute, Memphis, Tenn., engineers; N. H. Williamson, secretary.

Jellico, Tenn.—Nov. 8, 2 p. m. Constructing 5 7 miles of 8-in. to 15-in. pipe sewer. Letting postponed from Nov. 1 to Nov. 8. Walter G. Kirkpatrick, Jackson, Miss., engineer.

Kennewick, Wash.—Nov. 10, 11 a. m. Constructing main trunk sewer system. Certified check, $25. E. J. Wright, city clerk.

CONTRACTS AWARDED.

San Francisco, Cal.—Constructing 24-in. vitrified pipe sewer, to E. J. Gallagher.

Tracy, Cal.—Constructing sewerage system, to C. E. Vincent Contracting Company, Oakland, Cal., $56,300.

Park Ridge, Ill.—Constructing sewer and paving East Center street, to Cleary, White & Newman, $59,477.

Vincennes, Ind.—Sewer construction, for private corporation, to R. W. Laybe, Chicago, Ill.

Avoca, Ia.—Constructing sewer system, to C. H. Camoy, Harlan, Ia., $11,520.

Belle Plaine, Ia.—Constructing sanitary sewer system, to the Hoosier Construction Co., of Great Bend, Kan., $24,082.

Des Moines, Ia.—Sewer construction, to The Christie Construction Co., and to the J. W. Turner Improvement Co.

Keokuk, Ia.—Constructing sewer, to Cameron & McManus.

Marshalltown, Ia. — Paving Franklin street, to M. Ford, Cedar Rapids.

Primghar, Ia.—Constructing 3,036 ft. 8-in. sewer, to Garberick and Anderson, Sheldon, Iowa.

Columbus, Kan.—Constructing fifteen miles of sanitary sewers, to Koch & Koch, Joplin, Mo., $45,000.

Manhattan, Kan.—Constructing sanitary sewer, to the Kapz Construction Co., of Omaha, $9,240.

Birmingham, La.—The following sewer contracts have been awarded: Sanitary sewers in East Birmingham, to the Burkhalder Contracting Co., $7,505; sanitary sewers, to Ensley L. Brooks, $8,304.

Lake Charles, La.—Constructing 27 miles of 6 to 24-in. pipe sewers, to the Southern Asphalt & Construction Co., Birmingham, Ala.

Baltimore, Md.—Constructing high level intercepting sewer, to W. H. and E. F. Thompson Co., Baltimore, Md., $95,733.

Gilbertville, Mass.—Constructing sewerage system, to Lepards & Way, Springfield, Mass., $5,181.

Muskegon, Mich.—Constructing sewers, to E. W. Kruger, of Muskegon, $12,368.

Nashville, Mich.—Constructing sewer in district No. 2, to A. P. Southworth, of Adrian, Mich.

Hutchinson, Minn. — Constructing sewer extensions, to Fraser & Vanforth, of Rochester, Minn., $5,480.

Owatonna, Minn. — Constructing storm sewers, to J. P. Thon, $7,656.

Silver Lake, Minn.—Constructing sewerage system, to Fraser & Danforth, of Rochester, Minn., $5,479.

St. Paul, Minn.—Constructing sewers on St. Anthony avenue, to P. J. Ryan, $6,743.

Virginia, Minn. — Constructing sanitary sewers, to C. C. Butler, $9,270.

Kansas City, Mo.—Constructing south side sewer, to the R. J. & W. M. Boyde Co., $61,726.

Kansas City, Mo.—Constructing the Brush Creek intercepting sewer, to R. C. & E. Brown, $111,343.

St. Joseph, Mo.—Constructing sewer in district 54, to John Marshall.

Great Falls, Mont.—Constructing sewers, to F. E. Evans, $13,000.

Missoula, Mont.—Constructing storm sewers, to the James Kennedy Construction Co., Salt Lake City, Utah, $48,652.

Bradley Beach, N. J.—Extending sewerage system, to the Monmouth Contracting Company, Red Bank, N. J., $11,664.

Roselle, N. J.—Constructing sewer extension, to Louis Jacques, Elizabeth, N. J., $18,224.

Franklinsville, N. Y.—Constructing sewerage system, to J. B. Kuhn, Greensburg, Pa., $36,748.

Glens Falls, N. Y.—Constructing sewer system in South Glens Falls, to Sherman & Blackburn, $33,745.

Newburgh, N. Y.—Constructing sewer on Lake street, to Michael R. Stino, of Fishkill, N. Y., $10,440.

Perrysburg, N. Y.—Constructing a sewage disposal plant and sewerage system at the J. M. Adams Memorial Hospital, to Chas. A. Hager, of Buffalo, N. Y., $8,963.

Rochester, N. Y.—The following sewer

contracts have been awarded: Charles and Butler streets, to John J. Regan, $734; Clinton avenue, to H. N. Cowles, $2,945.

Yonkers, N. Y.—The following sewer contracts have been let: Constructing sewer in Bronx road, to Joseph L. Cuozzo, 176 Oak street, $16,643.

Yonkers, N. Y.—The following sewer contracts have been awarded: Belvedere Place, to Kelley and Hanifan, 763 Palisade avenue, $2,193; sewers in Glenn road and Glenn avenue, to the O'Rourke Contracting Co., 21 River View Place, $36,400.

Canton, O.—Constructing sewers, to F. A. Downs Construction Co.

Columbus, O.—Constructing Nilo trunk sewer, to H. E. Hunt, of Jackson, O.

Dayton, O.—Sewer construction, to Boyd & Cook, Dayton, O., $21,450.

Toledo, O.—Constructing main sewer No. 1119, to Albert Gryzbowski, $9,935.

Oklahoma City, Okla.—The following sewer contracts have been let: Sanitary sewers to Mayfield-Shaw Construction Co., $3,566; sanitary sewer, to the Stokes Construction Co., $3,560; sanitary sewers, to Derr & Broderick, $2,016.

Altoona, Pa.—Constructing reinforced concrete sewers, to Fogel & Co., Hollidaysburg, Pa.

Lebanon, Pa.—Constructing disposal plant to M. Bennett & Sons, Indiana, Pa.

Reading, Pa. — Constructing Franklin street sewer, to Fehr & O' Rourke, of Reading, Pa., $40,413; completing Rose Valley sewer, to same, $36,839.

Rock Hill, S. C.—Constructing three disposal plants, to Porter & Boyd, Charlotte, N. C.,, $48,475.

Nashville, Tenn.—Constructing sewers on Shelby and Sylvan avenues, to Quinn & Ellis.

Corpus Christi, Tex.—Constructing section of sewerage system, to Truehart & Jackson, of San Antonio, $31,000.

Dallas, Tex.—Constructing storm sewer on Pennsylvania avenue, to J. W. Smith & Son, $34,912.

Centralia, Wash.—Constructing sewers, to the Lister Construction Co.

Seattle, Wash.—Sewer construction as follows: Greenwood avenue, to Becker & Walker, 364 Johns street, $5,553; Interlake avenue, to Ferguson-Coit Co., Arcade Annex, $47,814.

Spokane, Wash.—The following sewer contracts have been awarded: Sixteenth avenue, to John Getman, East 17 102 Fifteenth avenue, $1,820; Sixteenth avenue, to J. L. Wood, East 1609 Sprague avenue, $4,030.

Spokane, Wash.—Sewer construction as follows: Construction in first ward district, to P. L. Langan, East 2327 Boone avenue, at $14,176; construction sewer in Twenty-fifth and Twenty-sixth avenues, to R. B. De Camp, East 805 Eighth avenue, at $5,721.

Vancouver, Wash. — Constructing trunk eswer, to the Johnson-Anderson Co., of Portland, $35,315.

Parkersburg, W. Va.—Constructing sewer on Laird avenue, to the Cantrel Construction Co.

Wheeling, W. Va.—Constructing sewer system on Sycamore street, to J. L. Fligar & Sons Co., of Patterson, Va.

Patterson, W. Va.—Constructing sewer on Sycamore street, to J. L. Fligar & Son.

Racine, Wis.—Constructing sewer in the Case Addition, to Andrew Thompson, $9,563.

CONTEMPLATED WORK.

Union Springs, Ala.—The city is contemplating the construction of a sewerage system. Wilburn Hill is engineer.

Little Rock, Ark.—The city is contemplating the construction of a storm sewer in the east end. H. Levinson, superintendent of public works.

Osceola, Ark.—The city is contemplating a sewer system to cost about $20,000. F. L. Gladish, sewer commissioner.

Nogalez, Ariz.—A $175,000 bond issue, for installation of water works and sewer system, has been voted.

Imperial, Cal.—The city is contemplating the construction of a sewerage system to cost about $27,000. Irvin Maupin, city clerk.

Los Angeles, Cal.—The city is contemplating the extension of the Wilshire boulevard storm sewer.

Denver, Colo.—Sewer extensions, to cost about $2,500,000, are contemplated.

Pueblo, Colo.—William Peach is preparing plans for sewerage extensions to cost about $35,000.

Zebulon, Ga.—The J. B. McCrary Co., Empire building, Atlanta, Ga., has been retained to prepare plans for a water works system.

Mt. Pleasant, Ia.—Plans are being prepared for a sewerage system to cost about $30,000.

Baltimore, Md.—It is stated that the sewerage commission will require $4,000,000 for sewerage work during 1912.

Kansas City, Mo.—Constructing sewer on south side, to R. J. & W. M. Boyd Construction Co., $16,726.

St. Joseph, Mo.—The improvement of the lower Whitehead sewer, to cost about $40,000, is contemplated.

Las Vegas, Nev.—The city is contemplating the construction of a sewer system to cost about $40,000.

Plainfield, N. J.—The city is contemplating the enlargement of the disposal plant.

Berea, O.—The construction of a sewer on Pearl street is contemplated.

Corona, N. Y.—The city is contemplating construction of sewers to cost about $200,000.

Glencove, N. Y.—A $150,000 bond issue for the installation of a sewerage system has been voted.

Mamaroneck, N. Y.—The city is contemplating the construction of a sewerage system and disposal works to cost about $122,000.

Oswego, N. Y.—The city is contemplating the construction of a sewerage system and disposal plant to cost $183,000. T. Chalkley, Hatton, consulting engineer, Wilmington, Del.

Sea Cliff, N. Y.—The village is contemplating a sewerage system to cost about $120,000. Clyde Potts, 30 Church street, New York, engineer.

Akron, O.—A $60,000 bond issue for sewer construction has been voted.

Springfield, O.—The city is contemplating sewer construction to cost about $1,000.

Xenia, O.—The city is contemplating the construction of a sewage disposal plant to cost about $40,000.

Pryor Creek, Okla.—A $10,000 bond issue for sewer extension has been voted. The Benham Engineering Co., 812 American National Bank building, Oklahoma City, Okla., are preparing plans. Bids will be received about Nov. 15.

Altoona, Pa.—Hering & Fuller, consulting engineers, New York City, are preparing plans for a sewer system and filtration plant for the city.

Garrick, Pa.—The borough is contemplating a sanitary sewerage system to cost about $70,000.

Duquesne, Pa.—Leo Hudson, of McKeesport, has been retained to prepare plans for a sewerage system.

Erie, Pa.—City Engineer B. E. Briggs has prepared plans and specifications for connection to the Mill Creek intercepting sewer.

Newcastle, Pa.—The city is contemplating the construction of a municipal light plant, sewage disposal plant and general street improvements.

North Wales, Pa.—The city is contemplating a sewerage system to cost $53,000.

Patterson Heights, Pa.—Carl S. Donaldson of Beaver Falls, Pa., has been retained to prepare plans for a sewerage system for the borough.

Pittsburg, Pa.—Upon Mayor William A. Magee's request the city council has authorized an appropriation of $5,000 for retaining consulting engineers on the proposed sewerage works.

Susquehanna, Pa.—The borough has been instructed by the state department of health to extend its sewerage system and construct a disposal plant.

Sioux Falls, S. D.— A$200,000 bond issue for sewer extensions has been voted.

Columbia, Tenn.—The city is contemplating the construction of sewers on South Garden and North High streets.

St. Elmo, Tenn.—An $80,000 bond issue for sewer construction has been voted.

Lampasas, Tex.—The city is contemplating the construction of a sewage disposal plant and a municipal garbage crematory. Mayor W. H. McGuire.

Coburg, Wash.—The city is contemplating the installation of a sewerage system.

North Yakima, Wash.—The city is contemplating the construction of a sewer system to cost about $50,000.

Tacoma, Wash.—The city is contemplating the construction of sanitary sewers in the alley between McKinley and Spokane avenues and on East I street.

WATER WORKS.

BIDS REQUESTED.

Loreaville, La.—Nov. 15. Constructing water works system, including wooden tank and tower. City clerk.

Jellico, Tenn.—Nov. 8, 2 p. m. The date for receiving proposals on the following water works material has been postponed from Nov. 1 to Nov. 8: 1,160 tons of cast iron pipe, 70 hydrants, 80 valves 500,000-gal. reinforced concrete reservoir, laying 12½ miles of 3-in. to 10-in. water mains. Walter G. Kirkpatrick, Jackson, Miss., engineer.

CONTRACTS AWARDED.

Tracy, Cal.—Constructing water works system, to the Western Engineering and Supply Co., Oakland, Cal., $21,200.

Harrington, Ill. — Constructing water works extensions and laying mains, to H. D. A. Drebe, of Barrington, $5,922.

Laporte, Ind.—Constructing water works system, to A. M. Osborn, Chicago.

Belle Plaine, Ia.—Constructing water works extension, to Malory and Company, Kewanee, Ill., $17,173.

Inwood, Ia.—Constructing water works system, to W. D. Lovell, 1415 Eighth street, Minneapolis, Minn., $12,644.

Syracuse, Kan.—Constructing complete water works and electric light systems, to the Tunkawa Construction Co., of Tunkawa, Okla., $35,010.

Boston, Mass. — The following water works contracts have been awarded: Setting concrete meter boxes, to Chas. J. Jacobs Co., $3,345; laying main in Frankfort avenue, to Hugh McNulty, $1,553; laying main in Orchard avenue, to Raffale Cartullo, $1,356.

Worthington, Mass.—Water works construction, to Crosby & Parker, Brattleboro, Vt.

Clarksville, Miss.—Water works construction has been awarded as follows: Air compressor and pump, to Allen Engineering Co., Memphis; pipe, to the U. S. Cast Iron Pipe & Foundry Co., Birmingham; valves and hydrants, to the Columbian Iron Works, Chattanooga.

Pacific, Mo.—A $15,000 bond issue for construction of a water works system has been voted.

Argyle, N. Y.—Construction of water works in Washington county almshouse, to John B. Dower, $90,030.

Matteawan, N. Y.—Laying 22,000 feet of pipe, to Partridge & Burke, of Irvington, N. Y.

Tarrytown, N. Y.—Constructing water mains, to Edward Jackman; furnishing pipe, to the Standard Pipe & Foundry Co.

Rutherfordton, N. C.—Constructing water works and electric light plant, to B. F. Rucker, Charlotte, N. C.

Dunseith, N. D. — Constructing water works system, to the Northern Construction & Engineering Co., Grand Forks, N. D., $6.000.

Toledo, O.—Constructing filter for water works system, to the Beers-Offutt Contracting Company, of Fort Wayne, Ind., $114,400.

Bokchito, Okla. — Constructing water works plant, to George Erickson, of Durant, Okla.

Muldrow, Okla.—Constructing combined electric light and water plant, to F. R. Stone, of Lima, O., $26,700.

Muskogee, Okla.—Constructing 6,000,000-gal. water purification plant, to W. W. Fuller, Muskogee, $45,027.

Medford, Ore.—Constructing water mains in South Holly street, to Jacobsen-Bade Co.

Jacksonville, Ore.—Constructing water works, to C. E. Bade, $35,000.

Tarentum, Pa.—Drilling test wells for the municipal water works plant, to R. H. Black, of Braddock, Pa.

Wehrum, Pa.—Paul Azzara, of Bartlesboro, Pa., has received the contract for constructing 20,000-gal. reservoir for the Lackawanna Coal & Coke Co.

Dallas, Tex.—Equipping three wells with pumping machinery, to the Harris Air Pump Co., Indianapolis, Ind.

Fond du Lac, Wis.—Constructing a new well on the grounds of the county asylum, to W. H. Carter Contracting Co., 2720 West Monroe street, Chicago, Ill.

New Lisbon, Wis.—Constructing water works and an electric light plant, to the Central Construction Co,, of Oshkosh, Wis.

Hull, Que., Canada.—Constructing water works extension, to Risson & Carriere, of Hull.

CONTEMPLATED WORK.

Nogalez, Ariz.—A $175,000 bond issue for installation of water works and sewer system has been voted.

Clayton, Del.—The installation of a water works system is contemplated.

Baxley, Ga.—The city is contemplating the construction of a water works plant.

Dalton, Ga.—The city is contemplating the installation of a filtration plant.

Atkinson, Ill.—The city is contemplating water works construction to cost $50,000. Jesse Steiner, city clerk.

Normal, Ill.—A $15,000 bond issue for the construction of a water works system has been voted.

St. Charles, Ill.—Water works extensions are contemplated and the following material will be required: 155 tons of -in. cast iron pipe, 22 tons of 4-inch cast iron pipe, 7,445 pounds special castings, 21 pipe hydrants, four 4-in. gate valves, five 6-in. gate valves. Bids will be asked about Nov. 1, 1911. E. N. Lamb, city engineer.

Ferdinand, Ind.—The town is planning to construct a water works system.

Mount Vernon, Ia.—Construction of a reinforced concrete storage reservoir is contemplated. W. W. Schirer, clerk; Iowa Engineering Co., Clinton, Ia., engineers.

New London, Ia.—The village is contemplating the construction of a water works system.

Redfield, Ia.—A $15,000 bond issue, for electric light and water works, has been voted.

Corbin, Ky.—The city is contemplating the construction of a water works system.

Hill City, Kan.—A $50,000 bond issue, for water works and electric light improvements, has been voted.

Valley Falls, Kan.—A $35,000 bond issue for the installation of a water works system has been voted. Burns and McDonnell, Kansas City, Mo., engineers.

Le Compte, La.—A $28,000 bond issue for water works system has been voted.

Roseland, La.—A $21,000 bond issue for a water works system has been voted.

Lansing, Mich.—The city is contemplating additions to the water works system.

Duluth, Minn.—The Crosby Water, Light & Power Co. has been incorporated with a capital stock of $50,000 by Francis H. De Groat, William P. Harrison and Grace Weiss.

Boonville, Mo.—A $10,000 bond issue for water works construction has been voted.

Unionville, Mo.—A $10,000 bond issue for water works construction and the reconstruction of an electric light plant has been voted. B. H. Bonvoey, mayor.

Amory, Miss.—A $25,000 bond issue for water works and sewerage system has been voted. The Solomon-Nortroff Co., Candler building, Atlanta, Ga., engineers.

Bethany, Neb.—The village is planning to receive bids on a water works plant, for which a $20,000 bond issue was recently voted.

Plattsmouth, Neb.—The City is contemplating the installation of a municipal water plant.

Newark, N. J.—The Gillette Water Co. has been incorporated with a capital stock of $25,000 by J. B. R. Smith, E. O. Clark and J. B. Reilly.

Plainfield, N. J.—James H. Fuertes, consulting engineer, 140 Nassau street, has been retained to prepare plans for a municipal water works system.

Fishkill Landing, N. Y.—The village has issued a $4,000 bond issue for water works extension.

Newburgh, N. Y.—A new system of mains to cost $4,000 will be installed on Colden and Water streets.

Albemarle, N. C.—Gilbert C. White, of Charlotte, N. C., is preparing plans for a $40,000 water works and electric light plant.

Selma, N. C.—The city is contemplating extension to the water works and electric light plant to cost about $20,000.

Akron, O.—A resolution has been adopted providing for the purchase of a water plant. R. A. Meyer, president of council.

Cambridge, O.—The village is contemplating the construction of a water works system to cost about $15,000. B. L. Rankin, president of council.

Cincinnati, O.—Superintendent Richards has recommended the construction of a filtration plant and a new settling basin.

East Liverpool, O.—The city is contemplating the construction of a water works plant to cost about $150,000.

Hubbard, O.—The village is contemplating a water works system to cost $30,000.

Ironton, O.—The town is contemplating the construction of a water works system.

Malvern, O.—The village is contemplating the construction of a municipal water works plant.

Navarre, O.—The city is contemplating the construction of a $25,000 water works system. L. E. Chapin, Canton, O., engineer.

Perryville, O.—A franchise has been granted to Frederick A. Witzler, to operate a power plant and water works system. H. R. Roether, mayor.

Boley, Okla.—The city is contemplating the construction of a water works system to cost $33,000.

Bristow, Okla.—A $5,000 bond issue for water works extensions has been voted.

Grove, Okla.—The city is contemplating the construction of a water works and electric light plant. Western Engineering Co., Oklahoma City, Okla., engineers.

Mandum, Okla.—The Benham Engineering Co., 812 the Northern National Bank building, Oklahoma City, Okla., will install two 8-in. syphon lines in connection with the water works system. About 2,000 lin. ft. of 8-in. cast iron water main will be required.

Ochelata, Okla.—The Western Engineering Co., Oklahoma City, Okla., are preparing plans for a water works system and electric light plant to cost $15,000.

Pryor Creek, Okla.—A $70,000 bond issue for a water works extension has been voted, and the Benham Engineering Co., 812 American National Bank building, Oklahoma City, Okla., are preparing plans. Bids will be accepted about Nov. 15.

Talihina, Okla.—A $25,000 bond issue for the construction of a water works system has been voted.

Westville, Okla.—The village has voted to construct a water works system. G. L. McKebbon, Muskogee, Okla., engineer.

Albany, Ore.—The city is contemplating the installation of a municipal water works plant.

Falls City, Ore.—A $5,000 bond issue for the extension of the water works system has been voted.

Gresham, Ore.—A $20,000 bond issue for water works extension has been voted.

Marshfield, Ore.—The construction of a municipal water works system is contemplated.

Portland, Ore.—The city is contemplating the extension of the water works system. D. E. Clarke, engineer.

Woodburn, Ore.—A $25,000 bond issue for water works improvements has been voted.

Bloomburg, Pa.—The city is contemplating the construction of a filtration plant.

Greencastle, Pa.—The city is contemplating the construction of a 12,000,000-gal. reservoir.

Lock Haven, Pa.—William Rathgeber, superintendent of the West End Water Co., has announced the proposed extension of the water works system to Dunnstown and Salona.

Martinsburg, Pa.—J. L. Henry, of Hollidaysburg, Pa., has been retained to prepare plans for a $20,000 water works system.

Tarentum, Pa.—Engineer Kennedy has prepared plans for a municipal water plant.

Tarentum, Pa.—Borough Engineer Kennedy has prepared an estimate for the construction of a 2,000,000-gal. reservoir and a system of drilled wells to cost $100,000.

Warren, Pa.—The city is contemplating the purchase of a water works system at a cost of about $490,000.

Kings Tree, S. C.—J. Newton Johnston, of Florence, S. C., has been retained to prepare plans for a $40,000 water works system.

Sioux Falls, S. D.—A $100,000 bond issue for the extension of the municipal water works system has been voted.

Baird, Tex.—The city is contemplating the construction of a water works system.

Honeyville, Utah.—A $12,000 bond issue for water works construction has been voted.

Preston, Utah.—The city is contemplating extensions to the water distribution system to cost $25,000.

Elma, Wash.—A $10,000 bond issue for

water works extensions have been voted.

Granger, Wash.—The construction of a water works system to cost $20,000 is contemplated. M. W. Avery, engineer.

Grafton, W. Va.—A $90,000 bond issue for construction of a water works system has been voted.

Wheeling, W. Va.—The board of control has been instructed to request bids for the construction of a filtration system.

BRIDGES.

BIDS REQUESTED.

Jasper, Ind.—Nov. 14, 1 p. m. Constructing bridge over White river at Portersville. Michael Sweeney, auditor.

Jersey City, N. J.—Nov. 2, 11 a. m. Constructing bridge over Passaic river. Certified check, $50,000. Patrick J. Condon, chairman joint committee of Hudson and Essex townships.

Fargo, N. D.—Nov. 2, 12 m. Constructing wooden bridge. Certified check, $50. Addison Leach, county auditor.

Zanesville, O.—Nov. 13. Repairing superstructure of Third street swing bridge. Certified check, 10 per cent. H. A. Duerhaus, county auditor.

Portland, Ore.—Nov. 3, 12 m. Constructing superstructure of a bridge over the Williamette river at Broadway. Ralph Modjeski, Monadnock building, Chicago, Ill., engineer; A. L. Barbour, Portland, auditor.

CONTRACTS AWARDED.

Ione, Cal.—Constructing steel bridge, to the Clinton Bridge & Iron Works, $10,530.

Oroville, Cal.—Constructing bridge, to the Ross Construction Co., $47,500.

Pasadena, Cal.—Constructing reinforced concrete viaduct, to Mesmer & Rice, $13,662.

San Bernardino, Cal.—Constructing two bridges, to the Security Construction Co., $4,150 and $11,797.

Jacksonville, Fla.—Constructing Hillsboro river bridge, to the Owego Bridge Co., Owego, N. Y., $205,000.

Boise, Ida. — Constructing three steel bridges, to the Missouri Valley Bridge and Iron Company, of Denver, Colo., $5,944.

Burley, Ida.—Constructing steel highway bridge across the Snake river, to the Portland Bridge and Iron Co., Portland, Ore., $17,289.

Pocatello, Ida.—Constructing bridge at McGregor's Ford, to Chas. D. Sheely, of Denver, Colo., $6,225.

Weiser, Ida.—Constructing 140-ft. span steel bridge, to the Coast Bridge Co., of Portland, Ore.

Chicago, Ill.—Constructing a bridge over the north branch of the Chicago river, to the National Contracting Co., Security building, Chicago, $29,000.

La Salle, Ill.—Constructing eight bridges, to the Joliet Bridge and Iron Co., of Joliet, Ill.

Shermerville, Ill.—Constructing bridges, to the Crowley Crosbury Construction Co., Davenport, Ia., $30,000.

Fowler, Ind.—Bridge contracts have been awarded as follows: Seven bridges, to Parker & Cheek, $2,043; nine bridges, to C. A. Miccum, $2,805; four bridges, to E. C. Weddle, $984; three bridges, to T. H. Warren, $705; four bridges, to C. A. Bolds, $1,172.

Franklin, Ind.—The following bridge contracts have been awarded: To L. A. Farr, Edinburg, Ind., $1,337; W. L. Wright, Nineveh, Ind., $5,580; to Albert Harman, Columbus, Ind., $1,775; to Harry E. Hill, Needham, Ind., $1,061; to Frank B. Hughes, Franklin, Ind., $1,376; to Haskell Ferguson, Franklin, Ind., $200.

Kansas City, Kan.—Constructing bridge at St. James street, to the Mt. Vernon Bridge Co., Mt. Vernon, O., $142,871.

Natchitoches, La. — Constructing bridge over the Cane river, to Austin Bros., of Dallas, Tex., $7,600.

Springfield, Mass.—The Lucius Engineering Co. has been awarded the contract for constructing a bridge over Main street.

Kansas City, Mo.—Constructing temporary pile bridge over the Kaw river, to the Mount Vernon Bridge Co., $13,889.

Canajoharie, N. Y.—Constructing bridge over the Mohawk river, to Lathrope Shea and Henwood Co., Buffalo, N. Y., $43,440.

Phoenix, N. Y.—Constructing concrete bridge, to Walter Bradley & Co., Fulton, N. Y., $18,000.

Lima, O.—The following bridge contracts have been let: Metzzer bridge, to Joe Mueller; constructing a concrete bridge, to Lyons and Seimer, of Lima, O.

Portland, Ore.—Constructing viaduct over tracks of the Southern Pacific, to the Pacific Bridge Co., Portland, Ore., $70,000.

Canajoharie, N. Y.—Constructing a bridge over the Mohawk river, to Lathrop, Shea and Henwood, of Buffalo, N. Y., $44,440.

Carlisle, Pa.—Bridge contracts have been awarded as follows: One reinforced concrete arched bridge, to the Martin Stone Co., of West Fairview, Pa.; constructing concrete bridge, to the Buchanan-Meredith Co., of Chambersburg, Pa.

Johnstown, Pa.—Constructing concrete and steel bridge, to J. A. Lord, Hastings, Pa., $9,000.

Pittsburg, Pa.—The commissioners of Stowe township have awarded contracts for structural work on Island avenue bridge to the Des Moines Bridge Company, Des Moines, Ia., $19,800.

Sussex, Va.—Constructing five bridges, to the Roanoke Bridge and Iron Co., Roanoke, Va., $5,350.

Everett, Wash.—Constructing steel bridge over the Sultan river, to the International Contract Company, 501 Central building, Seattle, $10,870.

Huntington, W. Va.—Constructing bridge over the Guyan river, to the Virginia Bridge and Iron Co. of Roanoke, Va., $12,500.

CONTEMPLATED WORK.

Globe, Ariz.—The county is contemplating the construction of a $12,000 bridge over the Black river. Frank L. Gates, clerk board of supervisors.

Pine Bluff, Ark.—Hendrick & Cochrand, of Kansas City, Mo., are preparing plans for a bridge across the Arkansas river.

Pasadena, Cal.—A $200,000 bond issue for a bridge across the Arroyo Seco has been voted. Waddell & Harrington, Kansas City, Mo., engineers.

Norwalk, Conn.—The city is contemplating the construction of a bridge across the Norwalk river.

Bliss, Ida.—A bridge to cost $10,500 will be constructed by the counties of Lincoln and Twin Falls.

Waukegan, Ill.—The city is contemplating the construction of a 400-ft. concrete viaduct at Genesee street. Westcott & Ronneberg, 189 West Madison street, Chicago, engineers.

Muscatine, Ia.—The city is planning to construct a steel and concrete bridge over Sugar street.

Norton, Kan.—The county commissioners are contemplating the construction of eleven bridges to cost from $200 to $500 a piece.

Lake Charles, La.—The city is contemplating the construction of a bridge to cost about $50,000 across the Calcasieu river. T. H. Mandell, city engineer.

Holyoke, Mass.—A new bridge will be constructed over the Connecticut river at High street. W. J. Howes, architect.

Lowell, Mass.—The city is contemplating the construction of a 6,000,000-gal. reservoir and the installation of a new pumping station. Frank A. Barbour, Tremont building, Boston, Mass., engineer.

Cleveland, O.—A $900,000 bond issue for the construction of a bridge to connect East and West Park avenue has been voted.

Corvallis, Ore.—The county is contemplating the construction of a $60,000 bridge across the Willamette river.

Portland, Ore.—Ralph Modjeski, of Chicago, has completed plans for the $800,000 Broadway bridge.

Charleroi, Pa.—The city is contemplating the construction of a 500-ft. concrete viaduct

Jeannette, Pa.—The city is contemplating the construction of a steel bridge at Second street.

Reading, Pa.—A $475,000 bond issue for constructing the Penn street bridge has been voted.

Athens, Tenn.—A $35,000 bond issue for bridge construction has been voted.

Selmer, Tenn.—The McNairy county court has made appropriations for two steel bridges.

Ft. Worth, Tex.—The city is contemplating the construction of a $2,000,000 bridge over the Trinity river.

Olympia, Wash.—The city engineer has been instructed to prepare plans for a bridge at Garfield avenue.

Seattle, Wash.—The construction of a $40,000 bridge at Ravenna park is contemplated.

STREET LIGHTING.

BIDS REQUESTED.

Champaign, Ill.—Nov. 4. Lighting streets with gas or electricity for a term of years. William Coughlin, mayor; Carl Hayes, city engineer.

Fremont, O.—Nov. 21. Bids will be received for lighting the streets and alleys for a period of ten years. Director of public service.

CONTEMPLATED WORK.

Elcajon, Cal.—Merchants on Main street are contemplating the installation of ornamental street light. The San Diego Consolidated Gas and Electric Company is the local public utility.

Americus, Ga.—A company, headed by Frank Lanier and Frank Sheffield, has been organized to construct a light, heat and power plant.

Baxley, Ga.—The construction of an electric light plant is contemplated.

Galena, Ill.—The town is contemplating the installation of boulevard lights on Main street.

Pana, Ill.—The city is contemplating a street lighting system.

Peoria, Ill.—The city is contemplating the erection of ornamental light poles on Jefferson street.

Huntington, Ind.—The city is contemplating the installation of an ornamental lighting system.

Montezuma, Ind.—The town has voted to install a municipal electric light plant.

Cedar Rapids, Ia.—The city is contemplating the installation of an ornamental lighting system.

Farley, Ia.—A bond issue for the construction of a municipal gas plant has been ordered.

Galva, Ia.—The city is planning the installation of an electric light plant.

Redfield, Ia.—A $15,000 bond issue for electric lights and water works has been voted.

Hill City, Kan.—A $50,000 bond issue for water works and electric light improvements has been voted.

Waterville, Kan.—The installation of a municipal electric light plant is contemplated.

Bay City, Mich.—Merchants on Water street are contemplating the installation of an ornamental light system.

Detroit, Mich.—The Grand River Improvement Association is agitating the question of ornamental lighting system. C. A. Coppock, president.

Unionville, Mo.—A $10,000 bond issue for water works construction and the reconstruction of an electric light plant has been voted. B. H. Bonvoey, mayor.

Lestershire, N. Y.—The board of trustees are contemplating the installation of ornamental light on Main street.

Poughkeepsie, N. Y.—The city is contemplating the extension of the ornamental street lighting system.

Selma, N. C.—The city is contemplating extensions to the water works and electric light plant to cost about $20,000.

Delaware, O.—The city is contemplating the purchase of the plant of the electric light and power company.

Perryville, O.—A franchise has been granted to Frederick A. Witzler to operate a power plant and water works system. H. R. Roether, mayor.

Sharon, O.—The city is contemplating the construction of a municipal light plant to cost about $50,000.

Springfield, O.—The city is contemplating the construction of a municipal light plant.

Grove, Okla.—The city is contemplating the construction of water works and electric light plant. Western Engineering Co., Oklahoma City, engineers.

Ochelata, Okla.—The Western Engineering Co., Oklahoma City, Okla., are preparing plans for a water works system and electric light plant to cost $15,000.

Dufur, Ore.—The construction of a municipal electric light plant is contemplated.

Eugene, Ore.—The village is contemplating the installation of a Tungsten electric light system to cost about $25,000.

Portland, Ore.—The installation of an ornamental municipal lighting system on Grand avenue is contemplated.

Carlisle, Pa.—The Carlisle Light, Heat & Power Co. has been incorporated for $5,000.

Midland, Pa.—The People's Electric Light and Power Co. has been incorporated with the following officers: E. H. Casey, president; J. I. Mcill, secretary; H. L. Guthers, treasurer.

Newcastle, Pa.—The city is contemplating the construction of a municipal light plant, sewage disposal plant and general street improvements.

Reading, Pa.—The City Light, Heat and Power Co. has been incorporated by Charles H. Bowman.

Sharon, Pa.—The city is contemplating the construction of a municipal electric plant.

Aberdeen, S. D.—City is contemplating the installation of a municipal light plant.

Ellensburg, Wash.—The city is contemplating the installation of an ornamental lighting system.

Spokane, Wash.—City Engineer McCartney has planned for special ornamental lamp posts to be erected on the Monroe street bridge.

Walla Walla, Wash.—The city is contemplating the construction of a municipal light plant.

Follansbee, W. Va.—The Steubenville and Liverpool Railway and Light Co. is con-

templating the installation of a street lighting system in Follansbee.

Prince Albert, Man., Canada.—P. B. Smith, consulting engineer, Winnipeg, Man., has prepared plans for the construction of a municipal light plant, to cost $250,000.

Niagara Falls, Ont., Canada.—The lighting of the boulevard between Niagara Falls and Port Erie with cluster ornamental lights is contemplated.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Berkeley, Cal.—The city is contemplating the erection of a garbage incinerator.

Newman, Cal.—The city is contemplating the construction of a garbage incinerator.

Columbus, Ga.—The construction of a garbage crematory, to cost $80,000, has been recommended by the health department.

Oklahoma City, Okla.—The city clerk has been instructed to advertise for bids for seven city lots, on which to build an incinerating plant, for which $25,000 is available.

Newcastle, Pa.—The city is contemplating the rebuilding of the garbage disposal plant, at the cost of about $2,000.

Lampasas, Tex.—The city is contemplating the construction of a sewage disposal plant and a municipal garbage crematory. Mayor W. H. McGuire.

FIRE APPARATUS.

BIDS REQUESTED.

Jacksonville, Fla.—Nov. 6. Furnishing 2,000 ft. of 2½-in. rubber-lined fire hose. T. W. Haunsy, fire chief.

South Bend, Ind.—The city is requesting bids for furnishing a 100-h.p. motor-propelled chemical engine and a motor combination hose cart and truck.

CONTEMPLATED WORK.

New Decatur, Ala.—The city is contemplating the purchase of an automobile fire engine, to cost $5,000.

Emeryville, Cal.—The city is receiving bids on a combination automobile fire engine and hose cart.

Hartford, Conn.—The purchase of fire alarm boxes, to cost $600, has been recommended.

New London, Conn.—The purchase of a motor fire engine, to cost about $6,500, has been recommended.

Washington, D. C.—Chief Wagner has recommended the purchase of a motor fire apparatus, to cost about $50,000.

Newcastle, Del.—The Goodwill Fire Co. is contemplating the purchase of a new chemical engine.

Sumter, Ga.—The city has voted to purchase an auto fire engine for the local fire department.

South Bend, Ind.—Chief Wilfried Grant has been instructed to prepare specifications for a motor-propelled chemical wagon, to cost about $6,500.

Burlington, Ia.—Chief Blank has recommended automobile fire apparatus for use in the city.

Fitchburg, Mass.—The city is contemplating the purchase of motor fire apparatus.

Malden, Mass.—The city is contemplating the installation of motor fire apparatus at all fire stations.

Taunton, Mass.—The order for a loan of $5,500 for a new automobile fire truck has passed the council.

Grand Rapids, Mich.—The city is contemplating the purchase of a motor-driven ladder truck.

Palmyra, Neb.—The town will purchase a chemical fire engine.

Rochester, N. H.—The city is contemplating the purchase of a steam fire engine and an auto combination wagon.

Asbury Park, N. J.—The purchase of an auto hose wagon for the Goodwill Co. is contemplated. Mayor Appelby has recommended the installation of new apparatus.

Dover, N. J.—The city is contemplating the purchase of motor-propelled fire apparatus.

East Orange, N. J.—New bids will be received for the installation of a fire alarm system. Fire commissioner.

Elizabeth, N. J.—Bids for a fire alarm system will be received soon.

Hightstown, N. J.—The city is contemplating the purchase of a hose wagon and chemical extinguishers.

Hoboken, N. J.—The Union Hill Taxpayers' Association has requested an automobile fire truck.

Linden, N. J.—The village is contemplating the purchase of fire equipment, to cost about $3,000.

Red Bank, N. J.—The formation of another fire company is contemplated.

South Orange, N. J.—Fire Chief Albert L. Conklin has been authorized to purchase 600 ft. of fire hose.

Herkimer, N. Y.—The village has issued bonds to the amount of $3,500 for the purchase of a combination fire apparatus.

Seneca Falls, N. Y.—The board of fire commissioners is contemplating the extension of the fire alarm system.

Asheville, N. C.—The city has voted to purchase a motor fire truck, to cost about $10,000.

Durham, N. C.—The city will erect a new fire station and purchase an automobile fire truck.

Norwalk, O.—The city is contemplating the purchase of a $10,000 auto fire engine.

Chambersburg, Pa.—The city is contemplating the purchase of motor fire apparatus.

Ellwood City, Pa.—The city is contemplating a bond issue of $15,000 for the purchase of a motor fire truck, 600 ft. of hose, etc.

North Hampton, Pa.—The installation of a fire alarm system is contemplated.

Shrewsbury, Pa.—The borough council will purchase 700 ft. of hose.

Wilkes-Barre, Pa.—The Stickney Hose Co. will purchase an automobile and combination truck.

Pawtucket, R. I.—The city is constructing a fire station, the equipment of which will be motor-propelled.

Columbia, S. C.—The city is contemplating the purchase of an automobile combination truck and chemical engine.

Coleman, Tex.—The city council has authorized the purchase of 500 ft. of fire hose.

Moundsville, W. Va.—The city is contemplating the purchase of additional fire apparatus.

Wheeling, W. Va.—The city is contemplating the purchase of an automobile fire engine.

MUNICIPAL ENGINEERING

VOLUME XLI NUMBER SIX

DECEMBER, NINETEEN HUNDRED ELEVEN

Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

BOOKKEEPING SYSTEM.

IN the November number we proceeded as far in the construction as to cover Time Distribution sheets, Identification Cards, Pay Roll Voucher Checks, Pay Roll Envelopes and the Pay Roll which remains on file in the office.

The methods outlined in that number covered the field end of the construction department and its connection with the office.

The independent work of the office contemplates the completion of these records by the bookkeeping system described in this issue.

In the first place we must have the ordinary double ledger, the same as is used by any ordinary mercantile business. In this ledger are carried the personal accounts of all individuals with whom the concern may be dealing. The larger accounts are carried under the firm name. Individual and miscellaneous accounts are carried under "Miscellaneous Accounts Payable or Receivable," and in making the ledger entries a vacant line is left opposite the respective debit and credit entry, so that when the account is settled an entry will show on both sides of the page. In other words, a vacant line on either side of the page is an indication that the account has not been closed. This naturally means that such accounts are carried as individual accounts under a miscellaneous classification, but are not necessarily in chronological order. For instance, if John Smith is credited with an invoice of $1,000.00 under date of September 15th, several other accounts may follow, but when this account is paid under date of November 20th, the entry is made exactly opposite the September 15th credit thereby automatically indicating that this particular transaction is closed.

Other larger and more important accounts where the invoices accumulate should be given an individual page.

Passing this subject of the ledger bookkeeping which is a more or less purely commercial transaction, we pass to the particular bookkeeping which is applicable to Contracting Practice. We will refer first to Plate XVII which shows a form for all charges growing out of the operation of the contracting organization aand the gross amount of which must check with the ledger. This distribution sheet, headed "Material Distribution," serves as an index to all expenditures and all other expenditure records in the office. In other words, while serving as an index or voucher record it gives the distribution of expenditures in such a manner that we may know where and to what account expenditures have been made. In the extreme right hand column appears the total amount of expenditures item by item as payments are made, while the distribution of same may be confined to one column or divided among several. The heading of the distribution columns are adjusted to each contract according to the character of work and particular attention is called to the fact that the columns are arranged for credit and debit entries so that each account or each distribution is completd in final result.

In case there are more distributions than can be carried on one side of sheet, cut off the end of sheet and continue distributions on reverse side.

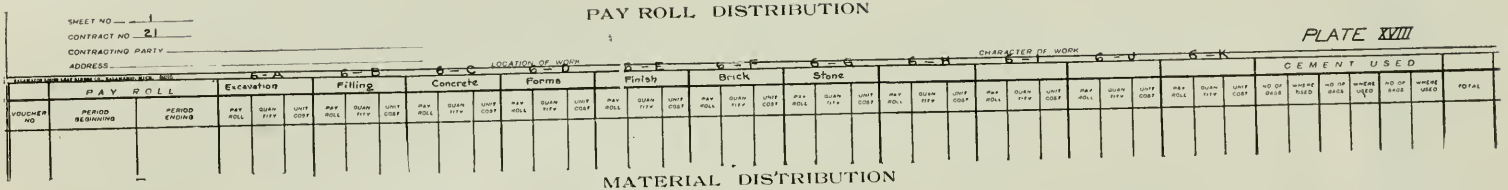
At the head of each column appears a numerical indicating the account number for the particular job the headings of the column being written in.

Supplementary to this general distribution sheet appears Plate XVIII which is the detail distribution of the pay roll which is in the same form as distribution shown on Time Sheet Plates X and XI. (November issue.)

Particular attention is called to the fact that the gross amount of Pay Roll

PAY ROLL DISTRIBUTION

PLATE XVIII



MATERIAL DISTRIBUTION

PLATE XVII

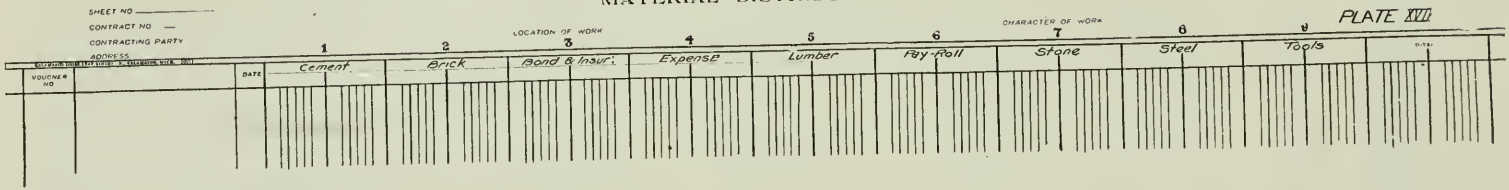


PLATE XIX.

ACCOUNTS PAYABLE No._____

THE [redacted] COMPANY.

TO_____ DR.

_____ 190__

ORIGINAL

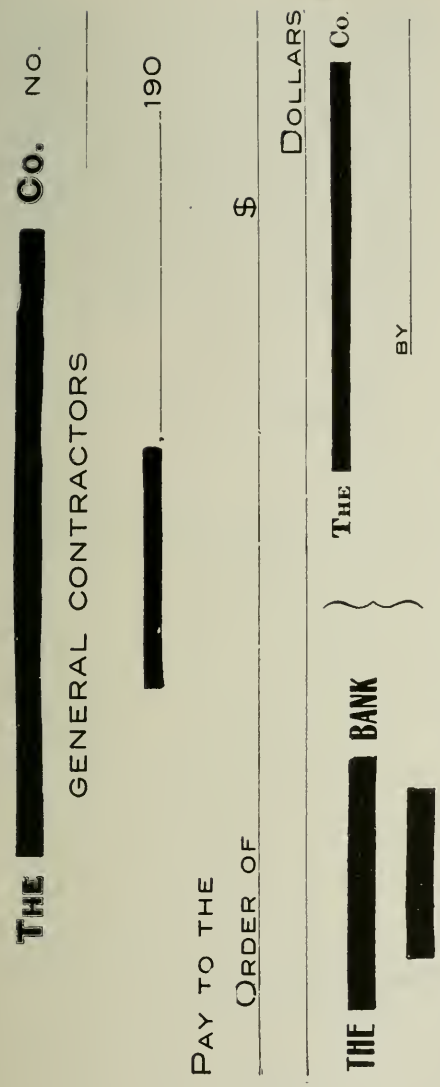
CONTRACT No	CONTRACT Act.	DISTRIBUTION	AMOUNT	DATE	ITEMS	AMOUNT	TOTAL.

POSTED _____ B. K.

AUDITED AND REGISTERED _____

APPROVED FOR PAYMENT _____ Sec'y _____ Pres.

appears on the material distribution sheet, Plate XVII, which properly may be designated as a general distribution. On this distribution sheet the Pay Roll account appears in column No. 6. On the detailed Pay Roll Distribution sheet appears this same account number with sub-letters heading each column agreeing with the letters heading column, Time sheet Plates X and XII. Under this system while no two jobs may have the same account numbers or letters for the same item, still if for any reason one particu-



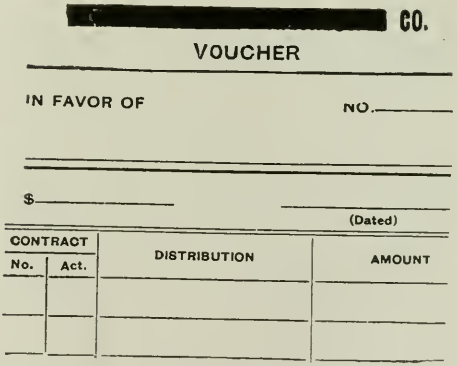
XX. CONTRACTING PRACTICE.
Reverse of Voucher.

lar job the nature of the account is indicated by the numeral and in case of Pay Roll this suffix of a letter indicates a particular classification and there can be no question or error in the proper bookkeeping or record of costs. The books shown in Plates XVII and XVIII are both loose leaf books.

The method of taking care of the Pay Roll has been fully outlined in the previous article of the November issue and we therefore proceed to the method of taking care of material bills and accounts payable.

It is preferable that accounts payable be handled under monthly vouchers. Two methods are suggested of which preference is given to the second. By the first method all invoices from any particular firm for the month are audited and recorded on the face of a voucher form, see Plate XIX. The reverse side of this voucher is in check form as shown by Plate XX. A duplicate of this voucher in same form is prepared at the same time as the original by means of carbon sheet. The reverse side, Plate XXI, showing distribution. To this duplicate are attached all the original invoices and thus duplicates and invoices are filed alphabetically, while the original voucher check is filed consecutively by number. By this method a record is kept both alphabetically and numerically. Both being filed folded, 3½ x8½, and filed in pigeon holes or boxes.

The second method, however, is recommended inasumch as it is sometimes impossible to clean up all accounts monthly. The difference lies in the fact that all invoices are attached to the original voucher. After being submitted and approved, payment is made by check, the voucher having space for voucher number and also check number. Inasmuch as pay-



XXI. CONTRACTING PRACTICE.
Duplicate of Voucher, Showing Distribution.

ment is made by check and the voucher remains in the alphabetical file, the same results are obtained as by the previous method, except, that we overcome the objection of the banks to handling folded checks and we have the opportunity for the payment of the voucher in repeated payments.

This form of handling accounts is shown by voucher form, Plate XXII. (Heavy paper.) The ordinary form of creck book is all that is necessary. A decided improvement over this system is shown by Plate XXIII, where the voucher is printed on the face of an envelope within which are contained all the invoices for any one particular firm for one

month. By this system not only do we obtain a distribution of the account but we have a record of each and every invoice. The opportunity is given for a definite record as to the time of payment, check number and receipt of any one invoice or of all invoices. At the same time reference is made to the ledger upon which page the particular account is carried. Should there be any question as to the account the contents of the envelope need not be disturbed.

Should there be any argument the face of the voucher envelope gives the record which may be verified by the contents of the envelope, and in case there is a question as to payment, an index is given to the different payments and check number which may be investigated to ascertain whether same was properly received and endorsed. This latter system is recommended as being a Combination Voucher and Filing System adaptable to any office large or small.

Should a creditor ask for an accounting and a checking up of account for any length of time all that is necessary to do is to refer to the alphabetical file containing his envelope month by month. An index is at once obtained to refer to the numerical file of cancelled checks. Under these conditions the ledger becomes simply a permanent book of record, inasmuch as the complete detail appears on the Voucher Envelope.

It will be noted that on the Pay Roll Distribution sheet the column is divided so that the cost of labor, and the record of amount of work performed are recorded, so that we may thereby arrive at the net unit of cost of the work. From this record in connection with the material distribution we are able to prepare statements at any time showing how the work is proceeding with reference to the original estimate. The information necessary as to the quantity of work performed is taken from the reverse side of the Time Sheet as shown by Plate XII, supplemented by office records and information not obtainable in the field.

In the payment of accounts the ordinary form of check book is used, upon the reverse side of the stub and check being stamped a form similar to Plate XIV. At the time a payment is made this form is filled out stating the job number and the account number, using the numerical index at the head of the column on the distribution sheets. If necessary, additional information may be shown by indicating under "Items,"

ACCOUNTS PAYABLE NO._____
CHK._____

COMPANY

To_____ Dr.

_____ 191__

CONTRACT NO.	CONTRACT ACT.	DISTRIBUTION ITEMS	DISTRIBUTION AMOUNT	DATE	ITEMS	AMOUNT	TOTAL

Received, inspected and found correct

_____ *Chf. Engr.*

Audited

_____ *Chf. Clk.*

Approved

_____

_____ 191

Received of the [redacted] CO.

_____ $_____

in full payment of account as stated above.

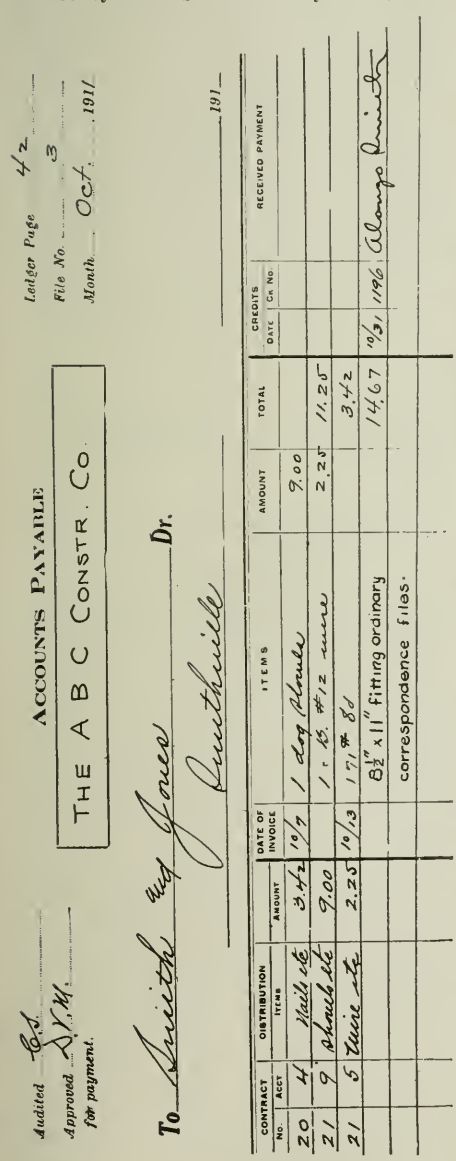
_____

XXII. CONTRACTING PRACTICE. Voucher Form.

what the payment or check is for. Such a check becomes a voucher check which is explained by the voucher envelope on file in the office and the endorsement of such a check is not only a receipt for payment, but indicates at once the account for which payment is being made. Inasmuch as upon the reverse side of the stub appears the same distribution record the distribution sheets may be posted from the stub book.

This system is not in any sense complicated and may be developed for from ten to fifteen dollars for printing and rubber stamps, and inasmuch as it is adaptable to any job, large or small, and any number of jobs, it is deserving of consideration.

The voucher envelope bearing as it does a file number which is the job number, the files for each job may be kept separate. On the other hand, the system may be used alphabetically and all accounts filed accordingly. The latter method is probably prefereable inasmuch as the information is more readily obtainable and, when the distribution at the left hand side carries the job numbers, any one account may be carried together for the month, regardless of how



XXIII. CONTRACTING PRACTICE.
Voucher Envelope. (8½ x 11 ins.)

STAMPED ON BACK OF STUB IN CHECK BOOK.

DISTRIBUTION			
JOB NO.	ACCOUNT NO.	TOTAL	
191	6	1000	
	4	10	
TOTAL		1010	00

DISTRIBUTION			
JOB NO.	ACCOUNT NO.	TOTAL	
191	6	1000	
	4	10	
TOTAL		1010	00

STAMPED ON BACK OF CHECK.

XXIV. CONTRACTING PRACTICE.
Check Distribution Stamp.

many jobs are in progress.

Liability Insurance, digested in detail in the September number, almost requires a detail Pay Roll Distribution such as Plate XVIII, inasmuch as the various classifications of labor are rated differently. The contractorr will more than pay for the extra time, trouble and cost to keep a set of distribution books in order to secure the benefit of a closer classification of rates.

At any time the Liability Company's Auditor appears, a complete summary of

the Pay Roll is shown, grouping each class of work in its own proper column. By lumping the Pay Roll, it must bear the maximum rate, whereas, if classified, a reduction is secured in the total premiums paid.

In case of large construction the division of the work by sections is of the utmost importance and it is recommended that each such section be considered the same as a sub-contract and the material and pay roll costs be distributed accordingly. In other words, instead of carrying a job as a complete whole we divide the total into sections in accordance with the original "Outline of Work and Itemized Estimate," (July and August issue), and that a separate account be opened for each section resulting in distinct time and work reports and separate distribution sheets.

By adopting this method the work of the field forces and the office are harmoniously adjusted and the work of the cost analysis at the completion of the contract is very much simplified.

The next article will take up the question of the analysis of the result shown by the field and office bookkeeping system introducing the idea of progress estimates and progress charts.

This analytical study is not only intensely interesting but is of the greatest importance to the up-to-date superintendent inasmuch as through the information furnished by the proper recording of the results of the work, he is able to discover the weak points and divide his best attention to same instead of considering the work as a whole. Without such detail information he is absolutely at a loss to prepare any record, and while the superintendent may be intelligent enough to recognize that certain parts of the work are not proceeding properly, he cannot be as strong a man as where he has the record and every part of the work so tabulated that he can day by day adjust his forces, revise his methods to gain the least cost.

Adaptation of Roads and Pavements to Local Rural Conditions.*

By Nelson P. Lewis, Chief Engineer Board of Estimate and Apportionment, New York City.

SINCE Tresaguet, in France, and Telford and Macadam, in Great Britain, showed, about a century and a half ago, that roads of broken stone were capable of carrying heavy loads and could be made practically impervious to water and proof against the action of frost, the broken stone road has been considered the highest type of country and village highway, and until recently it has been frequently found in city streets. In Great Britain such roads are extensively used by heavy traction engines hauling trains of loaded wagons. This use of traction engines on rural highways is rapidly increasing, Mr. W. J. Taylor, county surveyor of Hampshire, having estimated that there were in use in 1908 about 8,500

*FROM a paper before the American Road Builders' Association—6-PT.

such engines on the highways of England and Wales, or about one to every three and a quarter miles of main road.

By the beginning of the present century progressive countries had set about constructing a more or less complete system of water-bound macadam highways connecting the various centers of population. Within the last decade has appeared the high-speed road locomotive, or automobile, and it soon became apparent that, while water-bound stone roads stood up fairly well under rolling loads, they were not calculated to resist the action of driving wheels, and it is now universally recognized that a different kind of binding material must be used. The technique of modern bituminous macadam construction does not come within the limited scope of this paper, and no further reference will be made to it except as a modern type of road surface, it being assumed that very little macadam is likely to be laid in the future without the use of a bituminous binding material, either by the mixing method or by surface application. While the new type of macadam is calculated to resist the action of self-driven vehicles, the commercial use of such vehicles, which is just beginning in this country both as to the number of vehicles and their carrying capacity, will doubtless increase very rapidly, and this is one of the chief considerations which in the writer's opinion should govern the determination of the type of road to be constructed. The English traction engines already referred to, while slow-moving,

*From a paper before the American Road Builders' Association.

are very heavy and haul wagons with correspondingly heavy loads. This kind of traffic will necessitate the provision of strong surfaces and foundations, and it has been predicted that it will be necessary to place under macadam roads which are likely to be subjected to exceptionally heavy traffic a substantial concrete foundation.

There may in some cases be local prejudice against considering adaptability to motor car traffic in determining the kind of construction to be employed, but it must be remembered that in the State of New York owners of automobiles will during the current year pay into the highway funds of the State in the form of registration and license fees the sum of $900,000, or enough to pay interest and sinking fund on some $18,000,000, and the receipts from this source will doubtless increase rather than decrease. If motor trucks and traction engines are to come into general use, it would be manifestly fair to impose an additional tax upon all vehicles designed for a load of, say, 2,500 pounds or more on each wheel.

Without enumerating in detail the different kinds of pavement available for use in road construction, they may be classified under five separate types, as follows:

1. Broken stone, with bituminous binder, or roads of the macadam type.
2. Finely divided or pulverized mineral matter with bituminous binder, which for lack of a better name may be called roads of the asphalt type.
3. Stone blocks of various sizes laid in courses or in some regular pattern.
4. Artificial blocks in the form of brick, slag, cement concrete or bituminous concrete.
5. Sheet or monolithic concrete.

The problem with which we are confronted at the present time is the creation of a great system of good highways, the aggregate mileage of which will be enormous. Nearly all of these highways will be in rural districts, where the cost of their construction cannot be assessed upon the abutting property. The expense must, therefore, be met by the State or by the State, county and town jointly. The money must be borrowed through the issue of bonds or must be raised when needed by direct taxation. While the annual cost of maintaining these roads will be a serious burden, and this burden should be reduced to the lowest possible amount consistent with efficiency, and while the type of road to be built should be determined with regard to ease and economy of maintenance, the selection of the type of surface will in most cases be controlled by considerations of first cost. Where local stone is available for the entire road or even for the bottom course, and where exceptionally heavy traffic is not anticipated, there will be no hesitation in selecting type No. 1, or macadam with a bituminous binder. If the traffic is considerable, and if a large proportion of it consists of motor cars, the slight additional expense of employing the mixing method will be amply justified, while if the traffic is light and slow-moving, the somewhat cheaper, but in the writer's opinion less effective, plan of surface application may answer the purpose. This type of road where local stone can be used will permit of the building of the greatest mileage with the funds available. The importation of foreign stone at 100 per cent. greater cost to build a road which will last only 50 per cent. longer is not a good business proposition. There are districts where admirable road materials abound, but where the worst examples of roads are also to be found. Again, there are places where there are excellent roads and at the same time no suitable road material. Why is this? It is simply because a competent road engineer who is compelled to do the best he can with indifferent materials has produced better results than the incompetent or careless engineer who fails to use to advantage the better materials within his reach.

There are certain sections where there is no native stone available for road building and maintenance and where the cost of transporting it from distant quarries would be so great as to make a stone road unduly expensive. In such cases the most economical surface to adopt would be type No. 4, or one of artificial blocks. In sections which are devoid of stone it frequently happens that there is material from which excellent paving brick can be made, but if brick are not available other blocks may be used, which may be of slag or of cement or bituminous concrete, while sand or gravel must be supplied as a bed for the brick or blocks, and underdraining will in most cases be essential. In towns which are so located a road surface of the asphalt type may be used, but this pavement as commonly laid requires a concrete or other substantial foundation. It is not improbable that a pavement of the asphalt type will be developed in which the mineral matter, instead of sand or stone, will be loam or clay. The writer has seen samples of such a road surface, which appear tough, malleable and non-slippery, while if suitable material is readily accessible, it is predicted that its cost will be little more than that of a good macadam road.

It is generally recognized that the most durable of all pavements and the one requiring a minimum of erpenditure for repairs is stone block. Under horse-drawn

vehicles with steel tires it is rough and very noisy, and both the horse and the steel tire will be with us for many years. It was but a few years ago that granite or other stone block was considered a proper pavement to be laid upon such streets as Fifth avenue, in New York, or Euclid avenue, in Cleveland, but whether it is due to a greater appreciation of quiet or to more susceptible nerves, such pavements are now considered entirely unsuited to thickly settled communities, except where there is an intensive traffic and in streets largely given over to business and where noise is not a serious objection. The writer believes that stone blocks have not been given the consideration which they deserve for roads where the traffic will be heavy, where noise will not be a nuisance, and where the blocks once laid need not be disturbed. A type of road surface which has given very good results in Europe is that known as "Kleinpflaster," and is a pavement formed of stone blocks approximately cubical in shape, about three inches square on top, and three to four inches in depth, laid in concentric rings or curves with different centers, giving an arch or mosaic effect in appearance. This pavement gives a good foothold for horses, offers little resistance to traffic, is much less noisy than stone blocks laid in straight courses at right angles to the direction of travel, and offers an excellent surface for motor traffic. The cost of such a pavement laid over an old macadam and including the adjustment of the surface is said to be about the same as that of ordinary granite block. On many of the interurban highways of Germany this pavement has been laid to a width of from 15 to 18 feet, and is giving very satisfactory results, while its relative noiselessness makes it unobjectionable on highways where the abutting property is well built up. It is said that pavements of this type have been in use on heavily traveled roads for twenty-five years with practically no expenditure for repairs. Both the ordinary stone block and "Kleinpflaster" have claims to consideration on our rural highways which have not heretofore been recognized.

A type of pavement which has thus far had but limited use is that of cement concrete. Some of this pavement when well constructed of sufficient thickness and on an unyielding foundation has given excellent service, although owing to the personal element which appears to make it very hard to secure uniform results in the mixing and laying of concrete, it is difficult, if not impossible, to guarantee success. If too smooth, these pavements are unduly slippery under certain weather conditions, and they are not suitable, therefore, for heavy grades. It is essential that the concrete should be given ample time to set before traffic is allowed upon it. This is of the utmost importance, and it might not be extravagant to say that each additional day after apparent setting that all traffic can be excluded may add a year to the probable life of the pavement. The latest development in the line of concrete pavements is what is known as oil concrete, where a bituminous oil is added to the concrete before it is laid or is applied to the surface of the concrete after it is well set, as a waterproofing coat. If in addition to the surface application of oil there be also added a coating of fine stone or screenings which is renewed as it wears away, a protecting surface may be furnished which will make concrete pavements more generally satisfactory than they have heretofore been. From a paper by Mr. L. W. Page, presented to the American Society of Civil Engineers on November 1, 1911, describing a series of experiments made in the Office of Public Roads, Department of Agriculture, it appears that the strength of cement concrete decreases as the percentage of oil is increased, while the time required for setting is increased. The resistance to crushing of concrete containing 10 per cent. of oil appears to be about 25 per cent. less at the end of 28 days than that of ordinary concrete without oil. In toughness or ability to resist blows there appears to be little difference between oil-mixed and plain concrete. The most significant characteristic of the oil-mixed concrete is indicated by the absorption test. Plain concrete absorbed more than 6 per cent. of its weight of water in one day, while concrete containing 10 per cent. of oil absorbed 1.5 per cent. in the same time, and it was found that little, if anything, was gained in this respect by increasing the amount of oil up to 25 per cent. It is this low absorption which is the most promising feature of oil concrete.

The writer cannot attempt to specify under precisely what conditions any one of the types of road surfaces which have been enumerateed should be adopted. The object of the paper is to point out in a general way the adaptability of the several kinds of pavements to local conditions and to urge a more careful consideration of their availability, instead of assuming that all country or village roads or all parts of any particular highway should be treated in the same way as every other highway.

The conclusions which have been reached may be briefly summarized as follows:

1. In country highways the chief consideration will be first cost and the cheap-

est suitable material which is available must be used.

2. In roads where heavy traffic and excessive wheel loads are likely the most durable material should be employed and the foundations should be capable of sustaining very heavy loads.

3. Where noise is not a serious objection stone block will be the most durable and economical road surface under heavy traffic.

4. In suburban towns and residential streets a quiet and dustless road surface will be well worth the additional expense involved.

5. In city streets the consideration of cost can properly be subordinated to sanitary qualities quiet and cleanliness.

6. Between and along surface railway tracks the pavement should be especially adapted to the exacting conditions and should be laid and properly maintained by the railway company without public expense.

Municipal Water Purification Plant, Grand Rapids, Mich.*

By J. W. Armstrong, C. E., New York City.

THE filtration plant now being constructed for the city of Grand Rapids is the outgrowth of a project which was first seriously undertaken some twelve years ago. Little real progress was made, however, until 1909, when Messrs. Hering & Fuller were employed to report upon the best available method of securing a new water supply for the city. They advised in February, 1910, the construction of a mechanical filter plant having a capacity of twenty million gallons daily, for purifying the water of the Grand river, and that a complete water-softening plant, together with all the necessary appurtenances, including reaction and coagulating reservoirs, be built for preparing the water for filtration. A clear-water reservoir of three million gallons capacity was also recommended.

The water of the Grand river is a moderately hard water for the central West, and a very hard water, as viewed from the standpoint of waters of the Atlantic seaboard. It is about twice as hard as the water of Lake Michigan. It is frequently uninviting in appearance, partly due to the color or vegetable stain which it contains, and this is augmented at times by soil wash, which produces more or less turbidity or mud in the water as supplied to the consumers. As regards the bacterial analyses, the water, while polluted to an extent that makes it undesirable and at times unsafe for drinking purposes in its raw condition, is certainly not grossly polluted, and can be made entirely satisfactory in quality after being treated in a thoroughly well built and well operated filtration plant.

A brief description of the course taken by the water in its passage through the plant may prove helpful in understanding what follows:

The water passes from the intake into a concrete conduit to the pumping station, where it is picked up by a centrifugal pump and forced into an equalizing chamber in the head house. From here at times of high turbidity in the river, it enters into the grit chamber, where sand and heavy suspended matter is settled out. After passing through the grit chamber it enters a mixing chamber, where the chemicals are applied, and the water is kept in rapid motion until the proper reactions have taken place, when it is admitted into the coagulation reservoirs, where the water is prepared for the filters and most of the impurities are precipitated to the bottom. After leaving the coagulating reservoirs the water passes through the sand filters, and from there into the clear-water reservoir, from which it is finally led through a concrete conduit to the high-lift pumping station.

The pumping station is located centrally and adjacent to the filter gallery. The centrifugal pumps, which are of the single-suction vertical-shaft type, are located in a pit. The pumps are placed with their centers below extreme low water level in the river, which insures their being always primed. There are three raw-water pumps, each capable of lifting eight million gallons a day against a head of thirty feet. There are two smaller raw-water pumps, each of a capacity of four million gallons a day against the same head. On a tee in the suction line of one of these pumps a valve is attached which opens into the room and is operated by an extension stem from the floor above. This enables the raw-water pump to be used as a sump pump should the pit become flooded. The raw-water pumps are designed to be operated automatically, starting when the water falls below a certain level in the equalizing reservoir and stopping when it reaches a certain predetermined elevation. They are also capable of being operated by hand. All the raw water is discharged

*From a paper before the American Society of Municipal Improvements.

into a 36-inch force main laid under the floor of the filter gallery, in which is placed a 36-inch Venturi meter with an 18-inch throat. This arrangement effected quite a saving in the length of piping, but prevented an ideal arrangement of the pipe gallery.

The two wash water pumps each have a capacity of 1,000 gallons per minute against a maximum head of 52 feet. These pumps discharge their water into the wash water main in the center of the filter gallery. They are designed to stop automatically when the water reaches a certain elevation in the wash water tower, but they require to be started by hand. The reason for this method of operation is to enable the exact amount of water required for each filter washing to be accurately determined, which could not be done if water were to be pumped into the tank at the same time it was being withdrawn. The motors operating the pumps are located upon the ground floor, and they will be run by alternating current of 440 volts, transmitted through underground cables from the high-lift pumping station.

The water is pumped into an aqualizing chamber in the head house, which acts as a center of distribution, and from there it ordinarily passes directly into the grit chamber through a 42-inch by 42-inch sluice gate. During flood times the river water contains a great deal of sediment that is extremely desirable to get rid of before applying the chemicals. Most of the heavier suspended particles will be deposited by plain subsidence in traversing the grit chamber, which is 152 feet 8 inches long and 21 feet wide, and will hold about 367,000 gallons.

The mixing chamber is adjacent to the grit chamber and is 44 feet wide by 160 feet long and holds approximately 732,000 gallons. Wooden baffles of the "around-the-end" type are spaced three feet apart for the full length of this chamber. This type of baffle permits the operation of the plant with varying heads of water and offers reasonably good facilities for cleaning and inspection. Water can be drawn from the mixing chamber at four different points through the sluice gates. As the condition of the water changes, the time for chemical reaction can be shortened and lengthened. Should the water be drawn from the gate most remote from the entrance it will have to travel four times as far as it would if drawn out at the first gate and the time for chemical reaction would be correspondingly lengthened. The grit chamber and mixing chamber were designed with flat top and bottom, the bottom being reinforced in the style of a mushroom floor system for the purpose of resisting upward pressure.

There are two coagulating basins. The smaller of the two basins is 88 feet 6 inches by 118 feet 9 inches, and holds 1,134,000 gallons; the larger basin is 118 feet 6 inches by 118 feet 9 inches, and holds 1,452,000 gallons. The basins can be operated singly in parallel or in series. They are covered with groined arches supported by columns. It has been noticed in reservoirs with a few baffles that there is a tendency for water to short-circuit and for the floc to settle out unevenly in different parts of the reservoir. In order to overcome this difficulty and to maintain a more even distribution of the floc, the baffles in this basin are much closer than has been the case heretofore, being fifteen feet on centers. The water is withdrawn from the reservoirs over a skimming weir made of thin stop planks. The object in using the thin planks is to interpose a weak point that would give way should the water suddenly be withdrawn on the opposite side, and thus save the concrete work, which is not designed to withstand a full water load. They offer the further advantage of enabling the water to be taken from various depths below the surface.

A feature of this plant which has saved considerable piping and a number of valves, is the double conduit. The water from the mixing reservoir enters the lower compartment of this passage through one of four sluice gates and from there enters the coagulating basins through a sluice gate. After passing through the coagulating basins the water is taken into the upper compartment and conveyed on to the filters. By-passes consisting of sluice gates opening either into the upper or lower passage are so placed that the raw water may be cut out of the grit chamber and passed directly into the mixing chamber or directly into the coagulating basin, or all of the basins can be bypassed and raw water turned directly into the conduit leading on to the filters. Water that has been passed through the mixing chamber can also be admitted to the upper passage and taken directly to the filters, by-passing the coagulating basins. It is thus seen that an unusual degree of flexibility can be obtained in the operation of the plant.

There are ten filters with a normal rating of two million gallons each, five of which are on each side of an eighteen-foot pipe gallery. The filters are built of reinforced concrete, and are supported directly upon the groined arches which form the roof of the clear-water basin. They are 25 feet by 38 feet outside measurement. Each filter is divided into halves by a center gutter, and there are twelve concrete lateral gutters, sixteen inches wide. In washing, all water is carried off through the lateral gutters, none of it be-

ing allowed to flow directly into the center gutter. Each filter has about 738 square feet of sand area, aggregating 7,344 square feet for the ten filters.

The strainer system is constructed of concrete ridge blocks spaced in rows twelve inches apart across the filter. The end blocks are nine inches wide at the base and have perpendicular sides for a height of five inches, at which height a seat is left for the support of the perforated brass strainer plates, which extend in rows entirely across the filter. For a height of eight inches above the strainer plates the blocks are in the form of a truncated wedge. The space between the ridges is filled with four different sizes of gravel, held in place by a brass wire screen. The water, after passing through the filter sand and gravel, enters the water passages between the ridge blocks, from which it passes into the center collector and from there into the pipe system underneath the filters. In washing the filters the direction of flow is reversed, filtered water being passed rapidly through in the opposite direction.

Filter rate controllers of the Earl type are to be installed. These controllers are constructed in such a way as to respond to the pumps. If the water level in the clear-water basin is lowered, the rate of filtration will increase until a maximum is reached, when all filters will discharge at the maximum rate for which they are set until such time as the water again rises, when the filters will gradually slow down until the clear-water basin is full, and then shut down entirely.

As it would require very large pumps to supply the wash water at the high rate at which it is applied, it was decided to employ an elevated tank for washing the filters, which could be filled by means of small pumps during the interim between washes. This structure is built over the clear-water reservoir and the columns supporting it are carried to solid rock. The tank, supporting beams and columns, are built of reinforced concrete; the exterior is of brick to match the other buildings.

The main body of the head house is 46 feet by 60 feet 3 inches outside, which with the addition of a projection for the tower gives a total floor space of about 3,000 square feet. The building has a basement, ground floor, mixing floor and tower The basement is divided into two parts, one of which receives the water from the pumps and acts as an equalizing chamber and distributing point for the raw water. The other compartment concrushing machinery, and a vacuum cleanbins, together with the elevating and tains the steam boiler and coal storage er. Upon the ground floor are located the various operating stands for controlling the valves and sluice gates and all the chemical controllers. The operating floor contains all the apparatus for mixing and storing chemical solutions. The tower contains the bins for the storage of chemicals and the apparatus necessary for handling and conveying the material. The building is constructed of reinforced concrete with the exception of the outer walls, which are of brick.

From the solution tanks the chemicals will flow by gravity to the controllers which are located on the floor beneath, and after passing through the controllers will flow by gravity to the point of application to the water. The operator is enabled to vary the time allowed for chemical reaction to suit the changing condition of the water. For each of the solutions duplicate controllers of the Earl type are provided. They are all operated in conjunction with a Venturi meter and a master controller which so regulates the depth of solution that the head above the discharging orifice varies in direct proportion to the amount of water passing into the reservoirs through the meter. After the orifice has been properly set the action of the controller is entirely automatic, and however much the quantity of water passing through the system may fluctuate, chemicals in the correct proportion will be supplied. An additional alum controller is provided for furnishing the amount that may become necessary for corrective treatment. Each of the chemical solution tanks is provided with a recording gage, operated by a glass float. The recording device is to be enclosed in a neat glass case supported on a bracket on the outside of the tank.

For agitating the chemical solutions each of the tanks is equipped with a two-bladed propeller mounted in a funnel-shaped casing, with its bottom edge supported three inches above the floor of the tank. The propeller will be operated by an electric motor hung from the under side of the tank. The agitation is violent and keeps all inert or undissolved matter thoroughly in suspension until it is drawn off into the piping system. The agitation is particularly good in the corners of square tanks.

In April, 1910, the city of Grand Rapids by vote authorized a bond issue of $400,000 to pay for the new water works project, and of this amount, $350,000 was to be used for the filtration plant proper and $50,000 for conduits and some additional machinery to be installed in the main high lift pumping station.

The work of constructing the filtration plant was divided into four separate contracts, the first of which was for building the clear-water conduit, intake and drain. It involved the construction of

about 2,900 lineal feet of conduit and was awarded to J. P. Rusche in July, 1910, for $51,518.44. Contract No. 2, for the furnishing and installing of all pumping machinery was awarded to the Fort Wayne Electric Company, who coupled to their motors pumps made by the Buffalo Steam Pump Company, the contract price being $12,425. Contract No. 3 was for the various basins and substructures of the buildings. It included practically all the grading and the bulk of the concrete work. This contract was awarded to Prang & Co. for $123,842. The fourth contract was for the construction of buildings, wash-water tower, filters, piping, and all the special devices employed in the plant. The Roberts Filter Manufacturing Company, of Philadelphia, were awarded this contract for the sum of $159,882.

All plans for the construction of this plant were prepared by the firm of Hering & Fuller in their New York office, and since the dissolution of the firm. George W. Fuller has been employed as consulting engineer on the construction of the works. The construction has been done under the general supervision of Samuel A. Freshney, secretary and general manager of the Board of Public Works of Grand Rapids, Mr. R. E. Harrison being the resident engineer in direct charge of the work.

Practical Road Building.*

By John N. Edy, C. E., Highway Engineer, Billings, Mont.

Fundamental Principles of Road Building.

CONTRARY, perhaps, to the prevailing public opinion, road building is based upon certain definite principles, the observance of which is essential to economic results. No matter to what extent experienced road builders may differ as to other and less important details, they are absolutely agreed as to the primary laws that underlie all successful highway improvement. These principles may be stated as follows:

1. Drainage.
2. Compact foundation.
3. Suitable, compact and waterproof wearing surface.

The process of making a road in accordance with these laws is divided into three separate and distinct operations, namely:

a. Location.
b. Construction.
c. Maintenance and repair.

The results to be attained are service and economy.

It is evident, then, that if we are to make the most of our road funds the work must be planned to give the best service for the least money; and it follows that a careful observance of the primary laws noted above will provide these desirable results.

a. *Location.* Undoubtedly many miles of road are in bad condition and expensive to maintain because of poor location. This is due largely to the practice of establishing a road on a section line without considering the practicability of such route. True, if enough money is spent on construction, these poorly located roads may be made good. But it must be remembered that cheap right-of-way plus excessive cost of construction and maintenance is not economy. And no matter what the present needs of the community, there is always the probability of the future improvement of a road, at which time faulty location must be remedied at undue expense. For this reason a location must be feasible from the standpoint of future as well as present economy.

Assuming that the transportation requirements will be satisfied, the best location for any highway is that which—

1. Provides the best drainage.
2. Provides the best foundation.
3. Has most desirable grades.
4. Is nearest a suitable material for surfacing.
5. Has least number of stream crossings.
6. Provides the greatest safety for the traveling public.

Note that the length of the road is not considered. The road builder must realize that, so far as economical transportation is concerned—and that is the aim of any improvement—distance is measured in time rather than in miles. It must not be presumed, however, that directness of route is to be disregarded. Unquestionably a short good road is preferable to an

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equally good road of greater length. The point is that directness is a secondary matter; the permissible load is of more importance than the distance.

The road being in uniformly good condition, the load that may be hauled is determined by that which may be hauled up the steepest grade. For instance, it has been found that if a team can draw two thousand pounds on a level roadway, it can draw approximately—

1,800 pounds up a 1 per cent. grade.
1,600 pounds up a 2 per cent. grade.
1,000 pounds up a 5 per cent. grade.
600 pounds up a 10 per cent. grade.

A 1 per cent. grade means a rise of 1 foot in 100 feet.

A 5 per cent. grade means a rise of 5 feet in 100 feet, etc.

The above figures may not apply strictly to very short grades, but from them we may get an idea of the desirability of easy grades. Thus any means of establishing a proposed road without regard to the topography of the country must result either in decreased service or increased cost of construction. For, if a maximum grade of 5 or 6 per cent. is to be obtained, we must either resort to expensive excavation or avoid the hill by going around instead of over. Furthermore, side-hill construction is usually cheaper, the drainage is more easily accomplished and a wider choice of foundation is presented.

The question of maximum grades is determined largely by local conditions; as, for instance, the kind of traffic, the direction of heavy hauling, etc. An effort should be made, however, to secure as nearly a level road as is practicable. It has been stated in this connection that no roadway should be built perfectly level. This is not necessarily true. A well-maintained roadway will drain to the side ditches, which, if properly constructed, will have sufficient fall to remove the water coming into them. "Seepy" places in side-hill work may be avoided by shifting the road up or down the side of the hill, or by passing around the other side. Such places at the foot of a heavy grade in a deep cut may only be removed by sub-drainage.

We may assume that the less the cost of surfacing a road with gravel or stone, the sooner such improvement becomes possible; and the nearer the surfacing material to the road, the less the cost of placing it. It therefore follows that the otherwise satisfactory route should be selected that renders available a good deposit of stone or gravel. And, finally, because bridges and culverts are expensive, the fewer such structures required the less the cost of construction and maintenance. Railroad companies spend vast sums of money in order to avoid unnecessary stream crossings. It may be, and often is, possible to build a mile of good road for the cost of one bridge. The wise course is to build permanent structures, but to build only when necessary. The reader can no doubt recall instances of section-line location that require one or more useless bridges that are costly and a constant source of expense and annoyance.

Too often, especially on side-hill work, the road is located and constructed without regard for the safety of the traveling public. On account of the advent of the swiftly moving automobile, if for no other reason, it is imperative that excessively sharp turns and unprotected steep banks be eliminated.

From what has been said it may be seen that under no circumstances should a road be established without first having made a careful inspection of the several possible routes, and the final location determined only upon a thorough consideration of the conditions that affect its cost and value.

b. *Construction.* The construction of the road involves—

1. Staking out.
2. Clearing, grubbing, etc.
3. Grading—that is, excavating and filling.
4. Building the foundation.
5. Shaping the surface, or machine grading.
6. Placing the surfacing material.
7. Placing the bridges and culverts.

Inasmuch as hard-surfaced roads are placed on an earth foundation, the construction of a good earth road provides the foundation for any future improvement. That is, the construction of a macadam road is merely the placing of the surface material upon the previously built earth road as a foundation, assuming that proper grades have been established. The importance of the common earth road can hardly be over-estimated, and will be treated later.

Referring to the notes on location, it is evident that if these ideas are to be carried out the work must be staked. The final location of the line should be surveyed and marked by placing satisfactory monuments at angle points, etc. Stakes showing the cut or fill should be placed at distances varying from 25 feet to 100 feet. No supervisor can move earth economically by eye, and as the most expensive feature of earth road construction is the excavation, every effort should be made to eliminate unnecessary cost. Furthermore, no clearing can be properly done unless the boundaries of the right-of-way are plainly marked. Grading should be conducted by the use of proper tools and

machinery; the selection of the proper earth-moving device materially reducing the cost of such work. The road surface is shaped with a grader, such a design of roadway having been selected that will require the least amount of hand labor.

No highway may be considered improved unless bridges and culverts have been correctly designed, properly placed and built of durable material. No fill should be made on a wooden culvert because of the expense of replacing. These features will be treated under their respective subjects.

c. *Maintenance.* It is plainly uneconomical to make expenditures for highways and then fail to maintain them in good condition; not only is it uneconomical, but no road can render the service for which it was intended, except that it be kept in a serviceable condition. While it is not proposed to go into the maintenance of the several kinds of roads at this point, it is desirable that the reader's attention be called to the necessity of preserving the solidity of foundation and waterproofness of wearing surface. Unless this is done and the bridges and culverts are inspected and maintained, the value of the investment will be decreased and the safety of the traveling public impaired.

In later articles will be outlined briefly the methods of properly doing such road building as may devolve upon the supervisor. The reader must bear in mind that the essential requisites of a good road are service and economy, and that these are only attained through a proper observance of the principles outlined above.

The Municipal Power Plant of Richmond, Va.

Editorial Correspondence.

RICHMOND, Va., has recently completed and put in operation a most economical and efficient municipal electrical plant. The location of the city allows of the use of the James river for power purposes and the foresight shown in securing and making use of this factor indicates a progressiveness in municipal affairs very creditable to the city.

The first movement to secure a municipally owned electric plant in Richmond originated in 1888, but an indifference was shown which resulted in the failure of the project. In 1907 circumstances not directly connected with the question of electric power again brought the matter up for consideration.

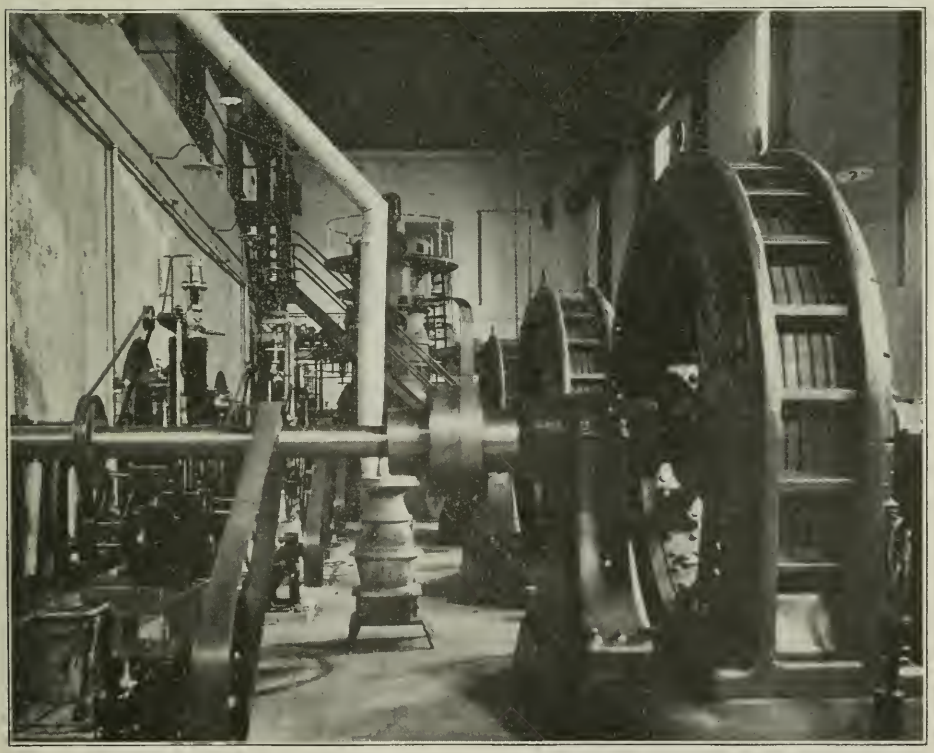
The city of Richmond derives its water supply from the James river, two plants being operated by water power and pumping into inependent distribution systems. It became necessary, by reason of the danger of pollution at the lower or old pump house, to pump all the supply from settling basins constructed at the upper pump house. This procedure would have rendered the lower station of no practical importance and its abandonment would have been necessary. The question of converting the water power at the lower station into electrical energy and transmitting it to the upper station for pumping purposes then presented itself. At this stage E. W. Trafford, consulting engineer of Richmond, was retained to make an investigation and return a report covering the situation and regarding the possibilities of an electrical power plant at the old pump house.

The possibilities of generating electrical power more than sufficient for pumping purposes led to the consideration of a municipal power plant, which would furnish power for street lights and possibly for private use as well. The consideration of this matter caused a great deal of opposition from many of those who did not approve of municipal ownership, and from the local utility interests and several of the newspapers of the city.

At that time the electrical field was controlled by the Gould interests, who, from a hydraulic plant located near the old pump house, furnished energy for the street railway, street lights, power and private use. The lighting system at that time consisted of about 1,000 arcs of the old type, 1,200 candlepower, 6½-ampere class. For this service the city was paying a yearly rental of $54.75, and all of the current was supplied by means of overhead wires.

In the very complete report which Mr. Trafford presented a careful comparison was drawn between the lighting conditions in Richmond and in other cities of the country. The private lighting company had endeavored to show that Richmond was securing service at a far lower rate than most cities, but in his report Mr. Trafford stated that considering the class of lights furnished, Richmond was in reality paying an exorbitant rate. A comparison of the cities of Chicago and Richmond, in which an equal illumination and the same number of hours of lighting was considered, showed that the Chicago

DAM AND HEAD RACE OF THE RICHMOND, VA., POWER PLANT.



GENERATORS AND TURBINES OF THE RICHMOND, AA , POWER PLANT.

plant was furnishing light at $87.94 per light per annum, including the cost of the plant, while Richmond on the same basis was paying $90. A comparison between Detroit and Richmond on the Richmond basis of lighting showed an annual cost to Detroit of $37 per light as against $55 for Richmond.

The rates for power were shown to be correspondingly high, as is noted in the following table, in which a comparison is drawn using corresponding loads of 1, 5, 40 and 100 horsepower during 9 hours per day of 300 working days per year:

—1 Horse Power—

	Per h.p. per annum.
Richmond, water power	$292
Charlotte, N. C., water power	144
Anderson, S. C., water power	81
Durham, N. C., steam power	120

—5 Horse Power—

	Per h.p. per annum.
Richmond, water power	$120
Charlotte, water power	60
Anderson, water power	60

—40 Horse Power—

	Per h.p. per annum.
Richmond, water power	$72
Charlotte, water power	36
Anderson, water power	24

—100 Horse Power—

	Per h.p. per annum.
Richmond, water power	$54
Charlotte, water power	36
Anderson, water power	20

Although it was not intended to furnish electricity for private lighting and such a step has not been taken up to the present time, Mr. Trafford's report showed that the city could furnish such current at the rate of 5 or 6 cents per kilowatt hour as against the following prices obtained by the company:

57 per cent. of all customers paid an average of 9.7 cents per kilowatt hour.

14 per cent. of all customers paid an average of 9.1 cents per kilowatt hour.

8 per cent. of all customers paid an average of 8.6 cents per kilowatt hour.

4 per cent. of all customers paid an average of 7.9 cents per kilowatt hour.

1½ per cent. of all customers paid an average of 6.6 cents per kilowatt hour.

4½ per cent. of all customers paid an average of 6 cents per kilowatt hour.

2½ per cent. of all customers paid an average of 5.8 cents per kilowatt hour.

6½ per cent. of all customers paid less than 5.8 cents per kilowatt hour.

These figures of costs and comparisons led to the decision to construct a municipal power plant to furnish electricity for street lighting and power purposes. The site suggested for this plant was the old pump house, which it had become necessary to abandon. Among the reasons which had been stated for abandoning this plant were the fact that the plant was located at the foot of a hill on which were located the three cemeteries of the city. In order to make use of the plant it would have been necessary to convey the clear water from the upper pump house and repump it with the obsolete machinery at the lower station. The old pump house site was accordingly proposed; it being proposed to generate power for use at the upper station as well as for street lighting purposes.

After considerable delay and much discussion Mr. Trafford's report was adopted and a bond issue of $250,000 was passed to provide funds for the construction of the plant. Additional bond issues of $100,000 for water works improvements and $85,000 for a distribution system were also provided.

The history of the acquisition of the water power rights by the city of Richmond is interesting in this connection. As early as 1840 the city realized the value of the water power and obtained the right from the legislature to sell or lease power. The original right to the water power was obtained from General J. B. Harvie, a wealthy land owner, in 1840, when he conveyed to the city of Richmond "the lands, dams, wells, islands lying between James river and Kanawha canal and Belle Isle, and also the land on the north shore of James river (described by certain boundaries), with all rights and privileges." He also obtained from the General Assembly an act confirming his rights and giving the right to raise the existing dam twelve feet above its present height and "to construct a wing dam on certain rocks and islands to a flat rock nearly opposite the waste of Ruthersford Mills."

The search of the old records telling of this grant and the succeeding efforts to relocate the old marks and boundaries described, led to a number of interesting occurrences. The extremity of the wing wall described was fixed by a "flat rock marked with the letter H." Three surveys were made under Mr. Trafford's direction, with the object of locating this "flat" rock, which was supposed to be some rather prominent mark on a certain island. At the termination of the third unsuccessful survey it was decided to relocate the point near a small rock near where it was supposed that the marker had been placed. One of the party, who was standing on this rock, asked that a board be thrown across to allow him to step ashore, and when he stooped to place this board he discovered a moss-grown H chiseled on the face of the rock. This settled beyond all dispute the limits of

the city's wing dam. Photograph 1 shows the head race, dam and wing dam running out to the islands in the background.

In constructing the new plant every possible use was made of the then existent old pump house. The old dam, twelve feet in height, was raised to eighteen feet and the head race walls reconstructed to give the needed additional height. The old walls of the pumping station were made use of, the new turbine wheels being set into the niches formerly occupied by the underflow water wheels of the old pump house, while the walls were built up to allow more head room.

ability of Mr. Trafford. The hydraulic equipment consists of three 42-inch Morgan-Smith turbines, directly connected to General Electric revolving field generators, 60-cycle, with a capacity of 425 kilovolt-amperes at 150 revolutions per minute, and equipped with a Lombard governor. An additional unit is being installed at the present time with a view towards a possible extension of the system, though the present equipment is fully adequate for present conditions.

The auxiliary steam-driven machinery consists of two 500-k.w. generators of the revolving field type, direct connected to two 750-k.w. generators, making 1,800 rev-

THE RICHMOND, VA., POWER PLANT.

Only a few changes were made in the tail race.

A thoroughly new and up-to-date station building was constructed, a new wing being necessary to accommodate the boilers for the auxiliary steam-driven turbines. The old pump house walls were built up to a greater height and more floor space was provided for the switchboard and transformer equipment.

A careful study was made of the water power possibilities of the plant and the class of machinery chosen and the provisions made for utilizing all available energy are a tribute to the foresight and

olutions per minute. The turbines operate condensing, a vacuum of 28 inches being obtained in the Alberg barometric condensers.

The starting arrangement on the exciter is very ingenious. The exciter system consists of two 50-k.w. motor generators. A Pelton water wheel is direct connected to the exciters, water being furnished to the wheel from an old disused main (part of the old pumping system), which extends back a mile to the new pump house reservoir. This main furnishes water under about 120 feet head, so that in order to start the exciter

system it is necessary only to admit enough water to turn the water wheel and start the exciters.

The boiler equipment consists of two 400-h.p. Babcock and Wilcox boilers. They are not equipped with superheaters.

The generator equipment is star-connected, delivering either 2,300 or 2,400 volts. Eleven 100-light constant-current transformers of the latest type have been installed and two additional units are at present being set up. The switchboard provides for twenty 50-light arc circuits.

ORNAMENTAL LIGHT STANDARD IN RICHMOND, VA.

The pumping equipment installed at the upper station and operated by power transmitted from the new plant consists of four four-and-a-half-million-gallon De Laval two-stage centrifugal pumps, direct connected to 200-horsepower 600-volt Westinghouse motors. The output from these pumps averages between ten and eleven million gallons per day; and for six months of the year all of the water used by the city can be pumped by this electrical system.

The first installation of street lights under the new system provided for about one thousand alternating current series enclosed arc lamps, requiring 7½ amperes in the place of 6½ amperes as did the old lamps. The major portion of the distribution system was over-head work but in the downtown district 65 lamps were supplied through lines laid underground in Orangeburg fibre conduit of the most improved pattern.

After the installation of the plant, the question of ornamental street lighting was agitated and as a result the nucleus of a most up-todate system has been constructed. The first appropriation of $25,000 was expended in placing the boulevard lights along Broad street, one of the main business streets and the most quaintly characteristic street of the city. The first installation consisted of eighty 5-lamp standards equipped with ball globes, all erect, and 100-watt tungsten lamps. An additional appropriation of $15,000 for 65 new lamp standards and equipment has been made. The lamp standards are of attractive design and well chosen as regards weight and height. They were furnished by the Morris Iron Works of New York City. The great distance between curb lines has made the problem of adequate illumination on Broad street very difficult, but the city is to be congratulated on the good taste shown in allowing a liberal distance (100 feet) between standards, making the light spacing uniform in both directions. The effect secured is not that of a glare over the entire street, but rather a subdued light, with, however, more shadow spots than would be necessary had the street been narrow enough to allow of a less distance between standards.

Though the new plant has been in operation only since January 1, ample evidence has been given of its success. In the place of an abandoned pump house site, the machinery of which was so obsolete as to be almost worthless, and a dam and property purchased for $50,000, the city now possesses a thoroughly up-to-date, efficient electric plant valued at $300,000. This plant is at present pumping from ten to eleven million gallons of water per day and furnishing current for almost 1,000 street lights in Richmond and about 150 arcs in the suburb of Manchester, which recently applied for current. The kilowatt output for the first seven months of operation is given as follows:

Month	Water Dept.	Broad Street	Street Arcs	Total Output
January	172,787	11,241	.....	188,082
February	247,400	8,835	.....	256,235
March	267,010	10,284	.....	277,294
April	261,830	8,416	43,730	313,976
May	299,270	8,133	38,846	446,249
June	233,590	7,190	135,582	330,322
July	187,550	7,190	135,582	330,322

As nearly as can be estimated at the present time, the arc lights at present used by the city, which are much superior to those which were furnished by the

private corporation, are costing about $33.00, including all interest and depreciation charges. The cost to the city under the old system was $54.75 per arc per annum. The saving in this department, taken together with that in the water department, is expected to amount to about $30,000 a year. In addition to these items, the indirect effect of the more improved street lighting in the downtown section, and the possibilities of further extension of the power facilities to public buildings and other uses, are additional evidences of success of the plant and the foresight of its projectors.

ORNAMENTAL LIGHTS ON BROAD STREET, RICHMOND, VA.

The Barrington, R. I., Experimental Road.

Editorial Correspondence.

DURING the time that Arthur H. Blanchard was in charge of bituminous road construction in Rhode Island, an interesting experimental road was constructed between West Barrington and Nayatt Point, near Providence. This road, built in 1909, has been open to traffic about two years, and some comment was made upon its condition in January, 1911, at a meeting of the American Society of Civil Engineers.

The road offers a comparison between different materials, all applied by the mixing method and with a flush coat spread after the mix had set. The subgrade was uniform throughout, consisting of a hard layer of clay and sand over a foundation bed of bricks which had been placed on the road some time before by local authorities. The grades vary from 0.50 to 1.14 per cent. and a very uniform condition of shade prevails along practically the entire length of the experimental section. The conditions of laying the material were made as uniform as possible and the macadam was the same over the entire section.

The macadam was built in two courses: The foundation course consisted of broken stone varying from $1\frac{1}{2}$ to $2\frac{3}{4}$ in. in longest dimensions, which was 6 in. deep when loose, and was rolled to 4 in. The top course consisted of stone of the same quality, varying in size from $\frac{3}{4}$ to $1\frac{1}{2}$ in., which was 3 in. deep when loose, and was rolled to 2 in. The rock used was a chlorthe gneiss, having the following characteristics:

Determinations.	Results.
Specific gravity	2.80
Weight per cubic foot	175 lb.
Water absorbed per cubic foot	0.46 lb.
Percentage of wear	4.6
French coefficient of wear	8.6
Hardness	15.7
Toughness	8
Cementing value	Fair.

The width of macadam was 14 ft. and the crown throughout was ¾ in. per ft. The top-course was mixed by hand with bituminous material until all stones were thoroughly coated. Most of the mixing was done by hand, with long-handled, square-pointed shovels, on plank platforms composed of three sections, each 8 ft. square. A tar-coating machine was used on the sections built with Springfield-Tarite and the U. G. I. No. 4 Road Compound. The mixing gang consisted of three experienced and five common laborers. In applying the flush-coat house brooms were used, the material being supplied to the spreader in steel-bodied wheelbarrows.

A traffic count was made during the months of June and July, 1909, and the following is the average for 8 hours:

Horse drawn vehicles	
One-horse vehicles	71
Two-horse vehicles	3
Motor vehicles:	
Motor cycles	1
Motor runabouts	9
Four or five passenger motor cars	43
Six or seven passenger motor cars	17

From this it will be noted that the traffic is very light during the summer months.

The experimental road contains only six sections, but adjoining it at one end is a section of crude tar mix with an asphalt flush coat, and at the other a section of tar and asphalt mix with an asphalt flush coat and a section of crude tar mix with no flush coat. These divisions will be noted with the six evperimental sections. The following comment is made as a result of an inspection on August 27,1911:

The first section is of crude tar mix with an asphalt flush coat and was built according to the standard specifications for bitumnious roads, then in use by the state. The surface showed the marks of horses' hoofs, though the temperature was only about 80 degrees. There were, however, no traces of excess asphalt, nor evidences of "bleeding" and the surface was smooth and firm enough to resist the distributed weight of wheels. Photograph 1 illustrates this.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
I. Crude Tar with Asphalt Flush Coat.

The second division is the first of the experimental section. It consists of 275 feet treated with U. G. I. Road Compound No. 4 which is a water gas tar manufactured by the United Gas Improvement Co. of Philadeplhia. In commenting on the laying of this section, Irving W. Patterson, resident engineer in charge, states:

"The first section laid with this material was allowed to remain over night before rolling, but this section was never compacted as well as where rolling followed close after the laying of the surface. Rolling in the early morning appeared to affect the surface in no way except to break up the stones of the No. 2 course. Rolling in the middle of the day, except on the day on which the material was laid, appeared to be but slightly more effective than rolling in the early morning. Hence it was found absolutely necessary to roll very soon after laying the No. 2 course. The great change produced by relatively slight changes of temperature can be judged from the fact that in the early morning at this season of the year the material in the barrels might be split with an ax, while earlier in the season it would flow from the bungs."

This section was hard, smooth and showed no hoof marks. The surface resembled a mosaic floor in appearance, as all excess of flush coat had been worn away, leaving the stones exposed but held firmly in place. Photograph 2 shows the appearance of this section.

Springfield (Mass.) Tarite was applied over a distance of 291 feet to form the third section. Rolling was done in the warm part of the day, as the material stiffened and did not compact well during the cold mornings and evenings. About two gallons of Tarite per square yard was used in the flush coat and about ⅝ gallons per square yard was used as a flush coat. Photograph 3 does not give a fair idea of the surface, as the flush coat was worn away and the binder was beginning to wear from between the stones indicating probable trouble. The surface was hard and smooth.

The fourth section consists of Tarite asphalt (10%) applied in the mix and a flush coat of the same material. Two gallons per square yard was used in the mix and a paint coat of ⅝ gallons per square yard was applied after the base had been thoroughly rolled. It was necessary, owing to the low temperature and stiffness of the mix, to prepare very small batches at a time and roll it on the day it was laid. At the end of two days the mix was set sufficiently to allow painting. This section had not worn as well as any of the previous sections noted, as the binder had worn away from the edges of the stones to a depth of a quarter of an inch or more, indicating that disintegration would result, though it had not as yet started. The surface was hard and dustless, with no excess of flush coat. This latter condition may be noted from Photograph 4.

BARRINGTON, R. I., EXPERIMENTAL ROAD
II. U. G I. Road Compound No. 4.

Section five, 168 feet in length, was constructed of Tarite-Asphalt (20%,) the same quantity of bituminous material being used as in the previous case. There was some difficulty in removing the material from the barrels due to its high viscosity, but the conditions of rolling and

BARRINGTON, R. I., EXPERIMENTAL ROAD.
III. Springfield Tarite.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
IV. Tarite Asphalt, (10 Percent.)

the length of time required for setting were practically the same. This material was hard, smooth and dustless and showed less wear of the material from between the stones, though the flush coat had been entirely worn away. It was very similar to the Springfield Tarite section in appearance.

The sixth section was constructed of Texaco macadam binder, only 1¾ gallons of material per square yard being used in the mix and ⅝ gallons applied to each square yard as a flush coat. Mr. Patterson in commenting on the conditions prevalent during the time this section was laid says:

"The weather conditions during the construction of this section were the most unfavorable during the entire period of construction. Owing to frequent rains and almost constant mists, it was impossible to keep the stone dry. Work was carried on, however, except when rain was actually falling, because of the lateness of the season and the desire to finish to a certain point before weather conditions prevented further construction. It was difficult to get the stone coated owing to its wet condition and the mix was exceedingly slow in setting up. It was impossible to apply the flush coat until three weeks after laying the stone."

Although the material had shown softness at the time the flush coat was applied, at the time it was inspected two years after construction it showed no softness whatsoever, was hard, clean, and showed no excess of flush coat, and no dust. Its condition may be judged from Photograph 5.

Section seven was constructed of a Malden (Mass.) Tarite mix in which 1⅝ gallons of bituminous material was used per square yard, and a flush coat of ⅝ gallons was applied at the end of 6 days. Rolling was done each day until a thorough compacting had been effected. The surface at the time it was inspected presented a mosaic appearance, was hard, clean of excess binder and dustless and the material was held firmly in place. Photograph No. 6 shows the appearance of the surface.

The two sections beyond the Malden Tarite do not belong to the experimental road, but nevertheless possess some points of value which justify their mention.

The first of these, section eight, was constructed of a tar and asphalt with a heavy tar flush coat. At the time it was inspected the temperature was only about 80 degrees, yet the surface was so soft as to be readily marked by the prints of horses' shoes, and near one end, which was on a grade, the surface was spongy and had commenced to crack and disintegrate.

Section nine was constructed of crude tar without a flush coat. This entire section had gone to pieces leaving great hollows filled with loose stones which appeared to have only a coating of soot and dirt rather than any traces of binder. It had been necessary to rebuild one portion of this section, near a bridge, in order to make the road passable. The rest of the section was passable but doubtless very unpleasant to ride over.

At the present time the experimental road does not offer basis for accurate comparison of the materials used; but it is evident that another year's wear will serve to intensify the differences which are becoming apparent, to a degree that will admit of definite conclusions being stated. One factor which renders this experiment of greater interest is the fact that the traffic, while rather light, consists principally of motor vehicles, and by reason of the few horses along the line of the road and the excellent surface offered, most of these motor cars pass over the road at a high rate of speed. The result of this high speed automobile traffic on the various bituminous roads constructed in this section will be noted when the experiment is completed.

The following table of cost data compiled by Professor Blanchard gives the costs of each of the materials noted, exclusive of the macadam:

Material.	Material per gal., f. o. b.	Freight, per gallon.	Loading and hauling, per gallon.	Material on road, per gal.	Heating material, per gal.	Mixing material, per gal.	Painting, per gallon.	Total cost of material in place, per sq. yard.
Malden Tarite	$0.080	$0.010	$0.007	$0.097	$0.008	$0.029	$0.021	$0.297
Texaco Macad. Binder	0.110	*	0.005	0.115	0.008	0.030	0.021	0.357
Tarite Asphalt (20%)	0.098	0.009	0.004	0.111	0.008	0.026	0.033	0.383
Tarite Asphalt (10%)	0.092	0.009	0.004	0.106	0.008	0.028	0.036	0.376
Springfield Tarite....	0.080	0.009	0.004	0.093	0.007	0.043	0.032	0.369
U. G. I. Road Compound No. 4.....	0.070	0.025	0.003	0.099	0.007	0.044	0.037	0.391

*Price per gallon includes freight.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
V. Texaco Macadam Binder.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
VI. Malden, Mass., Tarite.

The Water Filtration Plant at Toronto, Ont.

THE filtration plant which is just being completed at Centre Island, Toronto, affords a typical example of the use of concrete in this type of construction. It is possible to conceive that the tremendous strides which have been made in the methods of purifying the water of municipalities would not have taken place if such a material as concrete had not been available. An idea as to the extent of the use of concrete may be obtained by noting that the plant is constructed practically entirely of concrete, covers more than twelve acres, and to date more than 45,000 cubic yards have been placed.

While this Toronto plant is the first of any magnitude in Canada, similar plants are in operation at Pittsburgh, Philadelphia, Washington, Albany and other places. In 1896 the eminent English engineer, Mr. Mansergh, recommended that the city of Toronto obtain their supply of water from Lake Ontario and filter the same before delivering to the city. The condition of the water supply in Toronto was so poor that in the early part of 1909 action was taken, and in May of the same year the contract for the complete plant was awarded to Messrs. Dill, Russel & Chambers, of Toronto, while Mr. Allen Hazen, of New York, prepared the plans for the city and has been retained as consulting engineer.

Although laboring under many difficulties the contractors have executed a remarkable piece of work and the economical methods of handling the concrete from the time it left the Ransome mixers until it was placed have been the subject of much comment.

The filter beds are 312 feet by 117 feet each, six of them being located on either side of a central court, in which are situated the regulating houses, the entrance houses, the mechanical sand washers and the sand storage bins, together with the great number of pipe lines, varying in diameter from 72 inches down to 24 inches. At one end of one row of the filters is located a pure water reservoir 312 feet square, from which the filtered water is taken to the city.

All of the filters and the reservoir have concrete groined arch roofs, inverted groined arch floors, concrete piers, division walls and outer walls. The piers in the filters are spaced 13 feet on centers and are square. In the pure water reservoir the spacing is the same, and an idea as to the large number of piers erected in this entire work may be obtained by observing that in the reservoir there are 529 and 2,208 in the 12 filters. The height of the reservoir is 13 feet, while the walls are 14 feet high and average 3 feet in thickness; the corresponding figures for the filters being 11 feet and 3 feet 3 inches. For purposes of ventilation concrete manholes, made with the steel forms, have been erected in the center of every other square of the columns, being spaced 26 feet centers both ways, and it should be noted here that the facilitation for placing material inside of the filters were increased by their use.

The concrete was generally mixed in proportions of one barrel of Portland cement, 7 cubic feet of sand and 12 cubic feet of ballast, ranging from ¼ inch to 2 inches. By an endless cable side dumping cars were hauled from the lake shore, where were located the sand piles and the stone screens, to either one of two Ransome mixing plants. Here the material was elevated by tower arrangement into the bins over the mixer superhopper. Concrete was discharged from the Ransome mixer onto a platform with chutes leading to the cars. With this arrangement continuous mixing was possible. The system of industrial tracks was very extensive and the transporting of the concrete was done economically. The shifting of the tracks was promptly effected whenever necessary and as the work advanced the track was shifted from one finished roof to another.

As to the general operation of the filters it may be said that from the low-lift pumping station located on the lake shore side of the filters the water is forced through a 72-inch reinforced concrete pipe from which 36-inch reinforced branches are taken off at right angles to the inlet chambers under each entrance building, each branch supplying two filters. Upon entering the filters the water is spread over the surface of the sand to a depth of 36 to 48 inches and then successively passes through 3 feet 6 inches of specially cleaned and graded sand and three layers of broken stone and gravel. These gravel layers consist of, first, 7 inches of 2-inch broken stone or gravel; second, 2½ inches of 1-inch gravel, and, third, 2½ inches of ⅜-inch gravel, each size being carefully washed and graded.

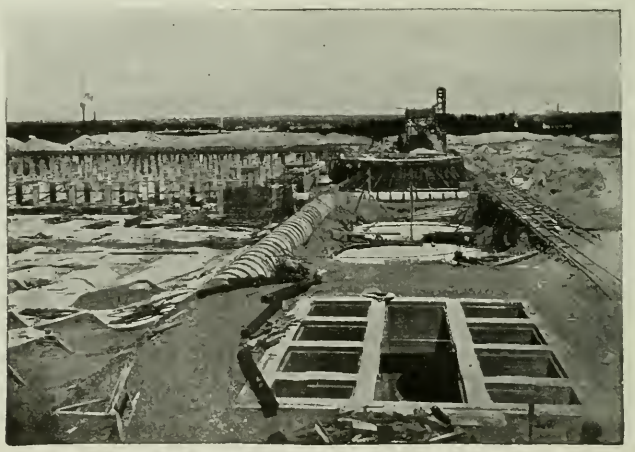
After percolating through these materials the filtered water is collected in 10-inch split tile pipes laid in parallel rows at intervals of 13 feet at right angles to and emptying into a main drain concrete box 6 feet wide. These drains

I. THE WATER FILTRATION PLANT AT TORONTO, ONT.
Concrete Mixing and Distributing Plant in Background, Left of the Center.

are covered with a reinforced concrete slab and empty into 24-inch cast iron effluent pipes, one of which leads from each filter to a regulator house. Each of these pipes is provided with a Venturi meter. After passing through the regulator house the water is then delivered by 64-inch and 72-inch concrete pipes to the pure water reservoir previously described. From this point it connects with a 6-foot steel pipe which runs across the island to the tunnel leading under the bay and thence connecting to the main pumping station on the Toronto shore.

The regulator houses, which are of concrete and of a cellular construction, will play a very important part in the operation of the filtration plant, inasmuch as they contain the outlet pipes and controlling gates of the several filters, and devices not only for obtaining an accurate measurement of the water's velocity through the filters, but also operation of any number of filters at one time as well as the flow of the filtered water to the pure water reservoir.

For the operation of the filters a constant supply of washed sand has been provided and for the storage of the same four circular bins have been constructed, each of which has a capacity of 512 cubic



II. THE WATER FILTRATION PLANT AT TORONTO, ONT.
Filter Beds and Clear Water Basin Under Construction on the Left.

yards, the inside diameter being 34 feet and the depth 21 feet. The sand will be removed from the filters by portable ejector hoppers delivering it through wrought iron pipes to sand washers. After being washed the sand will be delivered by ejectors to the above mentioned bins. By this method the contaminated surface sand in the filters will be cleansed and stored to be used again as required.

One of the most interesting things to be seen at the filtration plant is the sand washing plant. From a large dredge operating in the lagoons which intersect the island the crude material is delivered through pipes to a gradually widening table, which has the effect of reducing the velocity of flow from the pipe. The coarser gravel settles through an opening and is carried to a screen by a drag operated by an endless chain. The remaining material passes into a large "V" shaped box, the dirt and the finer sand flowing over the top with the surplus water. The heavier sand and fine gravel upon settling to the bottom of the box is delivered through spigot pipes to a washer box, at the bottom of which water pressure is applied and the remaining fine material removed. The sand is then elevated by bucket conveyor to the storage bin and from there by cars to the filters.

It should be remarked that in order to have dry ground to work on in putting in the foundations it was necessary to dig a drainage canal 4,000 feet long around the site, which involved the removal of 45,000 cubic yards of material, and in the same to establish a central pumping plant to keep the water in the canal low enough to permit of the above. The minimum depth of the canal is about 9 feet below average high water. By this method satisfactory results have been obtained, approximately 3,000,000 gallons of water having to be pumped each day during the period of ordinary high water.

When this filtration plant is completed the roofs will be covered with earth and sodded, the idea being to use this space as part of a large public park, the island being the favorite resort for picnics and outings for the citizens. The only indications there will then be of the filters will be the tops of the projecting manholes and the various concrete buildings. The office building has been erected entirely of concrete and is two stories high with basement. By rubbing and finishing the walls of this building with carborundum brick a finish not unlike white marble has been made possible, and with a roof covered with French A red roofing tile the entire exterior has been made very artistic.

It is anticipated that the work will be entirely completed before the end of October and the delays to date have all been caused by the difficulty in securing the laborers to live on the island. When finished the Toronto filtration plant will undoubtedly be worth investigation by municipalities contemplating the construction of filtration systems.

Problems of Road Construction.

By W. W. Crosby, Chief Engineer of State Roads Commission, Baltimore, Md.

THE speaker conceives it to be best to confine his remarks to details of actual work out on the job itself.

Generally speaking, the first operations are those of grading and installing the underground structures, such as culverts, abutments for bridges, and underdrains.

If any clearing or removing of trees and old stumps is to be done, it should be done promptly and thoroughly. Where practicable, the removal of trees should be accomplished by cutting off the roots around the tree a little distance away from the trunk and pulling the tree over so as to rip out the stump proper. The roots thus left in the ground will do no serious harm unless within a foot of the road surface. It is sometimes the practice of the speaker to allow trees to be cut off close to the ground and the stump to remain, provided that there is to be not less than two feet of new fill between the top of the stump and the bottom of the surfacing. It may be trite but it is at least safe to remark that in no case should a foreign stump be allowed to be placed in any embankment.

Underground structures should almost always be started as early in the proceedings as practicable, especially those which cross the road. Such procedure not only insures their being out of the way of the later work and gives more opportunity to conveniently handle the public traffic generally to be provided for over a road, but also allows more careful construction and better results in the backfill. Only

too often serious defects and extra expense occur in the surfacing over culverts too recently installed before the advent of the surface over them. In this connection the speaker will state that it is his practice to use vitrified clap pipe for all culverts from twelve to twenty-four inches in diameter where the covering over them is not less than two feet in depth and concrete boxes or cast iron pipe where the "head room" or cover is less. He has experimented in a very few instances with corrugated wrought iron culvert pipes, but is as yet unconvinced of their general desirability. In his experience, he has had no difficulties with the use of first-class vitrified clay pipe even under heavy fills of, say, twenty feet or more. Above 24-inch, the speaker prefers what is called "double strength" if clay pipe is to be used, but generally concrete boxes would be cheaper. Of course, in the use of clay pipe, care must be had in the laying and backfilling, especially to prevent the presence of anything like a stone nearer the pipe than, say, one foot. The speaker has seen a stone about the size of one's two fists forced by the fill above directly through the wall of an 18-inch clay pipe.

The bed on which a pipe culvert is to rest is a consideration frequently slighted. Only too often is it allowed to be of improper or of uneven character. This is of especial importance where short length joints of pipe are used. A bed of sand or fine gravel on which to lay the pipe is often desirable and advantageous. Even oyster shells or crusher screenings may be used. The speaker had one case ten years ago where a road crossed a bight of salt marsh by a pile-trestle about two hundred feet long. It was proposed to fill in the space instead of making the necessary renewal of the old wood work and to care for a small stream crossing the road through the marsh by means of a double line of 30-inch cast iron pipe. The surface of the marsh was at about mean high tide and the marsh mud of unknown depth. Therefore, along the slight stream depression through the marsh, the speaker laid a bed of oyster shells, the cheapest available mineral material, about ten feet longer than the pipe and about twelve feet in width. The shells were dumped from carts through the floor of the old bridge and spread out as necessary to probably an average depth of two feet and with their upper surface level and just above high tide. The pipes were then laid on the center of this bed and the filling over them was placed. The results have been entirely satisfactory.

Especial attention to drainage is necessary in Maryland work owing to both the prevalence of loamy or clayey soils and to the "open" character of the winters. A great deal of "French drain" is used. The pipe is vitrified clay and generally 4-inch, sometimes 6, in diameter with bell and socket joints. Stone, gravel or shells may be used for backfilling with apparently equal results. We think it preferable to install the underdrain just ahead of the surfacing work in most cases.

Practically all pipe ends should be protected by masonry head walls as a matter of protection and economy, to say nothing of appearance. Generally, our masonry in concrete, a "one-three-six" mixture, and on designs made in our own office. Flat slabs or girders, reinforced when necessary by twisted or corrugated steel rods, are usually sufficient. Occasionally, special circumstances warrant an unusual design. In such a case, bidders are given the opportunity to submit their offers with their own designs. These latter are checked by our office and the comparison is made between the offer and the office plans and estimates so that a decision may be made.

Of course the key to successful bridge work is in a proper foundation, and this is a subject by itself. Not much more can be said here than that almost all kinds of foundations have their place and the real problem is one of proper selection in each case.

Preliminary to the placing of the surfacing comes the preparation of the roadway for it, or what is generally known as "subgrading." The speaker considers the matter of a proper sub-grade one of the most important of all construction problems, and regrets to be obliged to state that it seems to be one too often neglected. In his judgment, more failures in the surfacing have had their rise in defects of the sub-grade than in any other source. In fact, the importance of a proper subgrade can hardly be over-estimated. A proper sub-grade should be firm, even and as little susceptible to damage by water as possible. Gravel, preferably sandy or with no excess of clay, gives an ideal subgrade when properly shaped and rolled. Clean sand will furnish a most satisfactory one, though it may bring about some waste surfacing material. In many localities, neither sand nor gravel is available. Crusher screenings may be substituted with very satisfactory results. Some clays will make a very good sub-grade, if not too wet so as to be muddy or rubbery, nor too dry so as to be dusty, provided the surfacing and under-drainage are so installed as to keep the clay in its good condition. Other clays cannot be thus handled. The speaker has secured satisfactory results in some instances by the use of a layer of gravel, sand or screenings from three to six inches thick immediately below the surfacing. Also rolling a layer of stone

into the sub-grade after shaping it—but before applying the first course of the regular surfacing, frequently relieves the defect of the sub-grade. Another way is to prepare the sub-grade by shaping and rolling as usual and then to apply a first course of the macadam of special composition. That is, instead of using for this course, one size of stone, to mix with the ordinary No. 1's, say, 50 per cent of sand or screenings (for instance by running the screenings and No. 1's together from the screen). Then spread this mixture on the prepared sub-grade, harrow it, and then roll. This has proved a very satisfactory solution in many cases where otherwise the failure of ordinary 8-inch macadam was almost certain. Probably the fine material in the No. 1's prevented the coming up of the sub-grade material into the macadam and thus its destruction in freezing and thawing wet weather.

In passing the speaker wishes to state that he considers this matter of sub-grade is only too often neglected in city work where a concrete base is to be used under the surfacing proper. Too much dependence apparently is placed on this concrete base in many cases and even unnecessary expense is had for such concrete when by proper attention to the sub-grade beneath it not only would better results, but also much saving in cost, be had.

In the reconstruction of old roads it frequently happens that but slight changes of grade are desirable. Many of these old roads, such as the "pikes," have been "stoned" in the past and so massively, but withal so crudely, that they now present to travel surfaces that are solid beds of stone (mostly large), whose unevenness and roughness furnish the main, if not the only, reason for their treatment. Many of the audience will recognize readily a statement from the speaker to the effect that those familiar with such an old road are hostile to any idea of digging into or removing, if only for the purpose of breaking up the large stone, the old roadbed. Nevertheless such a procedure is often the economical thing to do. If it can not be done for any reason and the old stone bed must be allowed to remain, then the grades for the finished surface must be properly adjusted so as to provide at least a minimum thickness of new surfacing on top of the high points of the old stone, and this minimum cannot successfully be less than four inches in the case of water-bound macadam. With proper care in bituminous work it can probably be reduced to two inches, and possibly in some cases even less.

Further, in such work, on an old road, the depressions to be removed furnish a problem. It will not do to fill them with an absorbent material like clay or loam, and filling them with surfacing stone may be necessary even if expensive. Frequently, however, a cheaper roadside stone of inferior quality will answer. The same remarks apply to thin layers of material to come between the old road bed and the bottom of the new surfacing.

In what may seem perhaps to have been a rather cursory way the speaker has at last reached the problems of surfacing. And here, perhaps, a breadth should be taken in view of the vast outlook.

Is there anything but "problems" in the subject of surfacing? And what a wide field of them offers, which yearly is becoming wider and more diversified, thanks to the activity of the proverbial American ingenuity. To discuss, or even to review, a list of all the problems in this field would be beyond the bounds of the present conditions, so the speaker will, in closing, merely mention a few salient points under the various kinds of surfacing on which he has convictions, or to which he feels it might be proper to direct your attention.

With sand-clay surfaces it is important to get an intimate, even and properly proportioned mixture of the sand and clay.

With unscreened gravel surfaces it is necessary that the gravel be free from stones larger than, say, a goose egg, and from an excess of fine material, i. e., either sand or clay. It must have, however, sufficient "fines" to fill the voids of the gravel stones, and preferably these "fines" sould be of a highly cementitious character. If too weak in cementing qualities naturally then something, such as pitch, must be added to make up for the lack of bond among the round gravel stones and thus to remedy their tendency toward displacement under traffic, especially in very wet and very dry weathers.

With screened gravel surfaces, when the correction of the sizing is had by the screens, the same remarks then apply. In some cases screened gravel may be satisfactorily "bound" with limestone screenings. With marl surfacing the problem is to secure the necessary uniformity of the material and then to properly compact it in place. Plentiful watering and rolling are important.

With broken stone macadam, in the experience of the speaker, the most necessary and at the same time the most difficult thing to obtain apparently is the proper compagation or interlocking of the broken stone. Almost always the rolling of the different courses is less than it should be for the best results, and the deficiencies in rolling are attempted to be made up for by using the screenings too soon and too profusely. Another problem is the securing of the utmost degree of

uniformity in the macadam layer as to thickness, evenness and homogeneity—no irregular depths of stone, no irregular thickness of courses, no pockets of material greatly varying in size, etc.

And with all these just mentioned surfaces, the speaker, at the risk of repeating, must again call attention to the problem of getting proper rolling or composition.

With bituminous surfaces the main problem is perhaps again the securing of uniformity. Practically all defects may be traced to the lack of it. The use of mechanical appliances of course always helps in securing regularity and homogeneity and generally tends to economy as well. Their desirability is beyond question.

With pavements of various kinds perhaps a general statement might be made that one important problem is to get them as dense as possible, that is, with sheet pavements, such as asphalt, bitulithic, concrete, etc., the mineral portion must be so proportioned that the voids will be at a minimum and the cement must then fill the voids. The other necessities of homogeneity, or uniformity and compactness, also apply. With block pavements the joints must reach a minimum and then be properly filled. The blocks themselves need uniformity and their placing must be evenly and solidly secured.

The speaker trusts he may have given an idea of the problems to be encountered in construction, if not a solution for all of them. In solving them, one and all, no factors will count more than carefulness and experienced intelligence.

Equipment of Electric Lighting Stations for Small Towns.

By Carl D. Hoskins, Manager of Electric Lighting Department, General Electric Co., Schenectady, N. Y.

IT is not possible in an article of this size to enter into any detailed description of all the apparatus required in an installation. A full description, however, may be readily obtained from the catalogues and descriptive matter published the electric manufacturcompanies upon the necessary electrical apparatus, and from numerous builders of well recognized and excellent engines and boilers.

The building should be constructed of the material which is most readily obtainable, with due consideration being given to the items of insurance and maintenance. It is often true that the cheapest first cost does not mean the cheapest building when these items are taken into account.

For this size of installation, general practice seems to have determined that fire tube boilers are the most satisfactory; they represent a smaller first cost than the water tube boiler and, in these sizes, gixe approximately the same economy.

ENGINES.

As a general proposition, it does not pay to install condensing apparatus in installations of less than 200 kw., and for this reason our plans have been based upon non-condensing equipments. This, however, is largely dependent on local conditions, and in localities where condensing water may be readily obtained, and where fuel costs are comparatively high, it may often be shown that the best economy is obtained by the installation of a condensing outfit.

The question of reducing the first cost of an installation has also led to the recommendation of belted units, and while this introduces the inconvenience always attendant upon the use of belts, it is believed that this inconvenience is more than offset by the difference in cost between belted and direct connected units of this capacity.

GENERATORS.

The generators recommended for these plants are built for belt connection to the engine and are of the alternating current type. They are designated as three-phase revolving field machines, and are capable of delivering 25 per cent. more than their rated load for three hours without injurious heating.

An alternating current machine is recommended rather than direct current; it has all the advantages which can be found in direct current apparatus, and, in addition, allows the use of higher pressure or voltage, thus greatly diminishing the cost of line material and making it possible to carry current to a much greater distance than can be done with a direct current machine. Each generator is provided with an exciter which is itself a small direct current generator.

It may be well at this point to call attention to the fact in this day and generation, with the possibility of power steadily and rapidly developing, that no consid-

eration should be given to single-phase generating machinery, as this is entirely unsuited to power work. There is no objection whatsoever to operating three-phase machines single-phase for lighting service, but the future should never be lost sight of in providing a generating equipment for the present.

SWITCHBOARD.

The switchboard of an electrical generating station has as its primary function the same purpose as the switchyard of a railroad system: On each main track, or bus of the switchboard, are delivered the units of electrical energy from the generators, and these units are distributed through the system of wiring for lights and motors, by means of the controlling switches located upon this board. The switchboard, then, is the keynote of the station, and it is particularly important that it be provided, not only with switches, but instruments which will show at all times the condition of the circuits, and with protective devices which will guarantee the greatest degree of safety. This is an item upon which it does not pay to economize too closely.

TRANSFORMERS.

Where current is generated and distributed at 2300 volts, it is necessary to have transformers in order to reduce this voltage low enough to be conveniently and safely carried into the buildings.

These transformers consist of two windings around an iron core. The inner or primary winding consists of a large number of turns of comparatively fine wire connected to the high voltage lines from the power house. The secondary, or outer winding, consists of comparatively few turns of larger wire from which the wiring into the buildings is taken. These windings are thoroughly separated from each other and from the iron core, by a suitable insulating material.

The structure thus described is placed in an iron tank and the tank filled with oil, which latter serves the double purpose of increasing the insulation and dissipating the heat resulting from the losses in the transformer. They are known as 60-cycle single-phase core type transformers. Their primaries are wound for 2080 volts and their secondaries for 110 and 220. In use, they are usually fastened on the poles.

For street lighting it is necessary to use a specially designed transformer, so constructed that it will give a constant current. It is constructed in the same general manner as the constant potential pole type transformers above described, except the secondary coils are so arranged with respect to the primary coils that they adjust themselves automatically to maintain a constant current on a lamp circuit; this is done by an arrangement of counterweights.

Street lighting is done by means of both incandescent and arc lamps in series on the same circuit. The receptacles in which these lamps are held are so arranged that if one lamp burns out, or for any reason breaks, the others will continue to burn without injury and without difference in their light.

The street lamps may be supported by a bracket or they may be suspended in the middle of the street by wires between two poles. The method of suspension and the position of the lamps depend entirely upon the character of the foliage along the street. If the bracket method is used, it is generally found most advisable to place lamps on both sides of the street; that is, first on the right side and then on the left.

The incandescent lamps recommended for this purpose are what are known as the tungsten series lamps. These have a very low power consumption and give a brilliant white light. Each lamp is provided with a shade of sheet iron or copper so designed that it distributes the light up and down the street.

METERS.

In each building where current is used a recording wattmeter should be installed. This instrument accurately records all current which is used and may be read at intervals, and the customer charged for exactly the amount which he has consumed.

The use of meters is highly recommended instead of what is known as the flat rate system, as they not only guarantee that the consumer pays for exactly what he gets, but also insure the company against the abuse which is so common under the flat rate system.

The first investment in meters is small sompared with the saving which they effect in the output of the plant.

BUSINESS MANAGEMENT.

As in any other enterprise, the success of a power plant depends largely on the progressiveness of the business management. The operation of the plant requires only the ordinary care and intelligence given to any steam engine equipment. The electrical end is far simpler than is ofttime imagined.

To the management falls the task of educating their public up to the uses of electricity, of obtaining customers and of keeping them satisfied.

The purposes for which current may be used may be divided into three classes: commercial lighting, street lighting, and power. Each class should be carefully investigated and developed.

COMMERCIAL LIGHTING.

This portion of the load demands the first and most careful attention on the part of the management. There is no question but that many people recognize the perfectly evident and obvious advantages of electricity, and are only deterred from using it by the fact that the first cost of wiring their premises is a larger outlay than they feel they can afford.

To meet this view, many managements have undertaken to wire buildings, charge only the actual cost of labor and material, plus a reasonable interest, and spread the payments for so doing over a period of from three to twelve months, so that at no time is it a burden to the customer.

The cost of wiring amounts to approximately $1.50 per outlet when visible or knob and tube wiring, as it is called, is used. If concealed wiring is desired, the cost amounts to somewhere around $4.50 or $5.00 per outlet. Even if the power company itself does not care to undertake the wiring business, it is not at all unusual for a small supply and construction company to be formed, often by the same men who are interested in the power plant, which pushes this work in close co-operation with the central station.

In the early days of incandescent electric lighting, it was found that considerable trouble and dissatisfaction arose among customers from using poorly made low efficiency and improperly rated lamps, and still further by continuing lamps in service long after they had become blackened, dimmed and useless.

As a satisfied customer is the best possible advertisement, central station managers found it necessary to advise and assist their customers in the selection and proper use of lamps, and, as the price became lower, the free renewal of lamps was adopted as the simplest and most effective method of insuring satisfactory service.

All new carbon lamps, manufactured by companies of established reputation, now maintain their efficiency within reasonable limits throughout life, hence it is not as essential as formerly for a central station to supply free renewals to insure satisfactory service. Furthermore, the new, improved high efficiency lamps, such as tungsten, are too high in first cost for free renewals, and as these lamps will supplant carbon lamps to a very large extent, it would appear that the future tendency will be more and more toward a customer paying for his renewals.

The marked improvement in the art of lamp manufacture in the past two years has resulted in a great advance in the incandescent lighting branch of central station service. Where, as formerly, for the ordinary incandescent lamp, it required from 3.1 to 3.5 watts energy for each candle light; we have now

The Gem, or improved carbon lamp, consuming only 2½ watts per candle of light,

The Tantalum lamp consuming only 2 watts per candle of light,

The Tungsten lamp consuming 1¼ watts per candle of light.

For a considerable portion of the central station service, the cheapest as well as the best lighting can be obtained only by using tungsten lamps. This lamp maintains its initial candle-power practically unchanged throughout its life, and has a color value closely approximating that of direct sunlight.

The average life of the tungsten lamp properly installed is over 800 hours. While the high cost, as compared with carbon, together with a certain percentage of accidental breakage and early burn-out may retard its rapid introduction, consumers can in time be educated to appreciate the fact that the average result they obtain will, at a given cost for current, make tungsten lighting the cheapest as well as the best. Many central stations have assisted in the introduction of tungsten lamps, thus greatly improving their service, by furnishing these lamps on a rental basis for each lamp installed of from 20 to 35 cents per month, additional to the regular meter charge for current supplied.

The most satisfactory and efficient lighting service can only be obtained by continuous education of consumers as to the best and most economical lamps for the various conditions of their service and the best method of installation from an illuminating engineering standpoint.

The following table is interesting as it shows the relation between first cost and cost of burning, and it will be noted that as the cost of lamp increases, the amount of power (*i.e.*, watts)) necessary to produce the light, decreases, and hence the cost of burning per hour decreases in direct proportion.

Type	C. P.	Watts	Price	Cost of burning lamp per hour, with current at 15c kw. hr.
Carbon	16	56	$0.20	.0085
Carbon	32	112	,30	.017
Gem	20	50	.25	.0078
Gem	40	80	.35	.0125
Tantalum	12.5	25	.50	.0038
Tantalum	20	40	.50	.0062
Tungsten	32	40	1.50	.0062
Tungsten	48	60	1.75	.0093
Tungsten	80	100	2.00	.015

STREET LIGHTING.

This branch of the service is a steady and sure source of revenue for any lighting company. It is a matter upon which

there should always be the closest co-operation between the lighting company and the board of aldermen or trustees, and they should work in harmony to determine what system will give the most efficient and satisfactory results.

Of late years there has been a great deal of investigation in connection with street lighting systems. The general consensus of opinion is that in business streets, or in localities where there is no foliage, arc lamps should be used. They may be hung fairly high, and as there is no obstruction, the light is diffused or spread up and down the street as far as its beams will carry; giving a brilliant illumination, not only upon the streets themselves, but upon the walls of buildings where it is just as essential.

In the shaded streets of the residential sections, a brilliant illumination is neither necessary or pleasant. Furthermore, the shade trees prevent the high hanging of lamps and the proper diffusion of the light up and down the streets. For this reason, incandescent lamps of 40 or 60 candle-power, placed at frequent intervals, give a much more uniform and satisfactory distribution of the illumination.

The arc light in such streets produces areas of intense light surrounded by unlit areas which appear all the darker in comparison. It must be remembered that incandescent street lamps can be operated for about one-quarter the cost of an arc lamp, therefore, many more may be had for the same money outlay.

The rates charged for street lighting are well established in different sections of the country, varying slightly with the price of fuel, and every attempt should be made to secure a long term contract for this service.

The Relation of Technical Men to City Planning.

THAT engineers have not contributed their proper share as citizens, to civic betterment movements, has been more than once asserted. The special qualifications of technical men for such work, however, were presented with some emphasis in a recent address before the Electric Club of Chicago, by Wm. B. Jackson, of the firm of D. C. and Wm. B. Jackson, Chicago and Boston. Mr. Jackson calls attention to the fact that the engineer, by the demands of his profession, is continually called upon to exercise just those qualities of foresight and attention to both technical, sanitary and moral factors in business that are so much needed in all effective city planning.

In manufacturing establishments, says Mr. Jackson, much attention is given to perfecting the most efficient arrangement of avenues of intercommunication and for the progress of material in the process of manufacture, and careful attention is given to obtain processes that will fit in with the requirements of the future as well as fulfill the needs of the present. An electric power plant built to fulfill the requirements of today, without careful consideration of its ability to appropriately expand to fulfill the requirements of the future is unhesitatingly classed as a blunder; yet we must admit that just this situation exists in our cities, and that on the whole our engineers and other technical men have not taken an active part in correcting the error.

When we leave the consideration of manufacturing establishments, we are prone to forget the lesson that has been learned there as the result of much experience, and we fail to apply the lesson to the wider problem of the cities. We are inclined to rest content with our cities as they may happen to grow, with very little thought of any general plan; whereby the avenues for traffic will be arranged to give effective intercommunication between all parts of the city itself and between the parts of the city and the outside regions; whereby the public utilities will be arranged to give the most economical and suitable service; whereby plenty of light, air and cleanliness will be made an essential part of the city; and whereby an attractive city will be assured.

Properly laid out highways are as necessary to the efficient operations of a city as are properly planned and executed avenues for the progress of materials which are being worked up in a manufacturing establishment.

We recognize the necessity of having good air and light with cleanly conditions if we expect to obtain the most effective work from employees in a manufacturing establishment, but how much do we on the whole recognize this principle when we consider the general business community and the homes of the masses in our cities? It is without doubt that there would be obtained a relatively greater increase in the usefulness of the people of a great city by providing the masses with plenty of light and fresh air to grow up with and live in, than by providing plenty of light and fresh air during work periods only.

We have a tendency to pass by the matter of an attractive city or the "city beau-

tiful" as something for the consideration of architects, landscape gardeners and artists alone, but this is a mistake. We are all working for better and more efficient men and women. Our points of view may be different, but we should all be striving for a common end. Can any one really believe that men and women living in squalid quarters can be so broadly effective as they would be if living in harmonious attractive quarters? The same situation exists here as in the electric light plant. The morale of the people is raised by attractive surroundings.

Taking into consideration the tendency of the time, it does not seem to be quixotic to believe that the day is not very remote when an ugly spot in a city will be considered as a public nuisance in much the same way as an unpleasant odor is so considered today. It is likely that artistically inharmonious surroundings have a more far-reaching effect upon the character of our citizens than the presence of unpleasant non-pestilential odors. It is only because cities do not feel the same keen competition to which manufacturing concerns are subjected that it is possible for them to survive under the conditions imposed by lack of appropriate plans, but that does not lessen the economic loss occasioned by such lack.

We must of necessity come to the conclusion that a city cannot grow to its most perfect stature without an officially accepted plan having the hearty support of the people, since we cannot have a most effective city unless it is laid out in accordance with such a plan, nor is it possible to otherwise properly provide for its growth. We are all aware that a large electric light or telephone company cannot thrive at its best unless it is able to expand with the guidance of a well-thought-out plan. Then why should we expect the greatest corporation of them all to rise to its best without such a plan having the earnest backing of every thoughtful citizen? City planning is a subject well worthy of the earnest thought of our broadest citizens, amongst whom are the technical men.

That the larger municipalities, at least, are awakened to the value of city planning is evidenced by the following list, and, as will be noted, the technical men are prominent in the list of those interested.

The following is a list of towns and cities engaged in city planning, with an engineer or city planning expert in charge:

CITY.

Altus, Okla.—L. P. Jensen.
Atlantic City, N. J.
Baltimore, Md.—Olmsted Bros.
Boston, Mass.—Society of Architects.
Buffalo, N. Y.—George Cary, 164 Delaware avenue, Buffalo.
Chicago, Ill.—Daniel H. Burnham.
Cleveland, Ohio—Daniel H. Burnham, Arnold W. Brunner, 33 Union Square, W., New York.
Colorado Springs, Colo.—C. M. Robinson.
Columbia, S. C.—Kelsey & Guild.
Columbus, Ohio.
Denver, Colo.—C. M. Robinson.
Detroit, Mich.—C. M. Robinson, F. L. Olmsted.
Gary, Ind.
Glen Ridge, N. J.—John Nolen.
Grand Rapids, Mich.
Greenville, S. C.—Kelsey & Guild.
Harrisburg, Pa.—Warren H. Manning, 101 Tremont building, Boston.
Hartford, Conn.—F. L. Ford.
Indianapolis, Ind. — Charles Carroll Brown, Dr. F. B. Wynn.
Jamestown, N. Y.—C. M. Robinson.
Janesville, Wis.—Dr. C. C. Dwight.
Jersey City, N. J.
Kansas City, Mo.—Geo. E. Kessler.
LaCrosse, Wis.—John Nolen.
Los Angeles, Cal.—C. M. Robinson.
Louisville, Ky.—F. L. Olmsted, Jr.
Madison, Wis.—John Nolen, Harvard Square, Cambridge, Mass.
Memphis, Tenn.—George E. Kessler, 523 Frisco building, St. Louis.
Milwaukee, Wis.—John Nolen.
Minneapolis, Minn.—Warren H. Manning.
Montclair, N. J.—John Nolen.
Newark, N. J.—John Cotton Dana.
New Haven, Conn.—Olmsted Bros.
New Orleans, La.
New York City—Harold A. Caparn, Water Park, Jamaica Bay.
Oakland, Cal.—C. M. Robinson.
Omaha, Neb.
Philadelphia, Pa.—Albert Kelsey.
Pittsburg, Pa.
Portland, Me.—Olmsted Bros.
Portland, Ore.—Olmsted Bros.
Providence, R. I.
Reading, Pa.—John Nolen.
Ridgefield, N. J.—C. M. Robinson.
Roanoke, Va.—John Nolen.
St. Louis, Mo.—George E. Kessler.
St. Paul, Minn.
San Diego, Cal.—John Nolen.
San Francisco, Cal.—Daniel H. Burnham.
Savannah, Ga.—John Nolen.
Scranton, Pa.—John Nolen.
Seattle, Wash.—John C. Olmsted.
Springfield, Mass.
Staten Island, N. Y.
Walla Walla, Wash.—John C. Olmsted.
Washington, D. C.—F. L. Olmsted, Daniel H. Burnham, Charles F. McKim, Augustus St. Gaudens.
Watertown, N. Y.—C. M. Robinson.

EDITORIAL COMMENT

The Effect of Public Service Commissions Upon Securities of Companies Operating Thereunder.
Investigation of Austin Dam Failure Needed.

THE EFFECT OF PUBLIC SERVICE COMMISSIONS UPON SECURITIES OF COMPANIES OPERATING THEREUNDER.

This subject was discussed at some length in this department of MUNICIPAL ENGINEERING in vol. xl, p. 425, and the general conclusion reached was that in general the effect of the control of public service corporations by a central state expert body would be beneficial. Some corroboration of this position is found in an address of James G. Cannon, president of the Fourth National Bank of New York, before the recent convention of the American Electric Railway Association. He shows the difficulties arising from limited terms of franchises and from fixed rates of fare having no direct relation to the cost of the service. He also considers the exploitation of urban and interurban lines on the one hand and the necessary expansions on the other as factors affecting capitalization and dividends thereon; the fluctuations in prices at which stocks can be sold in the market on account of changes in management, distrust of the management by prospective investors, often without reason, and the uncertainty of the bond market for any but the strongest companies. He includes in his conclusions the following significant paragraphs:

I believe the answer to most of the problems which at present confront electric railways will come largely through the workings of the public service commissions, if these bodies are wisely appointed and perform their functions in an equitable manner.

Unquestionably the personnel of these commissions has yet much of a practical nature to learn from the management of railways but if the commissions and the railroads will work in harmony with a singleness of purpose for the welfare of the traveling and investing public, in my judgment we may soon look for a marked improvement in every feature surrounding the traction situation.

If in the past electric railway securities have not been considered a prime investment, the managers of traction corporations have themselves largely to blame.

In the last number of *Public Service*, a magazine which is at all times a consistent supporter of the public service corporations, even to the extent of misrepresenting the operation of municipal public service plants, quotes approvingly the arguments of the Newark *News* in support of the New Jersey Public Utilities Commission, prefacing its extracts from those arguments with these words:

New Jersey politicians are agitating for abolishment of the New Jersey Public Utilities Commission, which was recently organized in that State. The claim is made that the expense of the commission is a burden upon the taxpayers, but those who have followed the workings of the commission declare that the politicians are opposing state regulation because it has deprived them of the power to deal in their own manner with the public utility corporations in their respective localities.

There is no question that the opposition to the commission form of regulation is strong and that there will be a fight in the next legislature to either repeal the law that created the commission or modify it to such an extent that the body will have but little power. Many of the newspapers of the State are upholding the commission and point to the work it has accomplished to better conditions, even during the short time it has been in operation.

Regulation by commission in New Jersey, however, is in its infancy. An insufficient law gave a commission limited powers for ten months, and then the present stringent act went into effect only five

months ago. In spite of these limitations, much has been undertaken by the commission in the year and a quarter of its existence. Most important questions are now before the commissioners for their determination.

Among the deeds of the commission which are approvingly quoted from the *News* are the following:

It has established a rule that limited franchise grants should provide for safeguarding the public interest in continuous and uninterrupted service at and after the expiration of the term of the grant, and shonld require the maintenance of the property in good order throughout the full term of the grant. This means that the commission will refuse to approve a franchise that does not provide for a continuance of good service to the public during the term of the franchise and after the termination of the grant.

It has made an order that corporations receiving a certificate of approval for issuing securities must make half-year reports of the amount of stock or securities issued, sold and delivered, and the extent to and the purposes for which the proceeds have been disbursed. This is a safeguard against stock-watering in the future. It has compelled one corporation to cease evading the purposes of the law in the issuing of bonds.

It has prevented competition with a regulated monopoly (a gas company) by refusing to approve of a franchise granted by Shrewsbury township, Monmouth county, to a rival corporation. The refusal was based on the sound ground that the field was a proper one for a natural monopoly (regulated), and competition would be ultimately wasteful and expensive.

It has forced a telephone company to give adequate service upon demand.

It has held that the existing passenger rates between Arlington and Jersey City are fair because of lack of competition.

It has brought about a reduction of Pullman rates to shore points.

It has compelled compliance—temporarily, at least—with the trolley transfer obligations imposed bf the terms of Newark ordinances.

It has forced a substantial reduction of rates for gas and electricity in a number of communities served by the Consolidated Gas Company of Long Branch.

It is hardly possible that men so intimately acquainted with the side of the case on which the public service corporations are ranged would approve of the State utilities commissions in this emphatic way if they were not of opinion that the condition of their companies would be better under competent and efficient regulation than under present conditions.

Attention is called also to the extract from the *Review of Reviews* quoted in the Question Department.

Even the partial control of rates and conditions of street railway operation by the city of Cleveland under provisions which give some approach to the same requirement of fair treatment has protected the stock of that company, according to the statements of Cleveland financiers, so that it is now called a "gilt edge investment security" and "is bound to become the leading investment stock of Ohio and the price has risen from par to 4 or 5 points above par since the people of Cleveland voted to accept the ordinance.

INVESTIGATION OF AUSTIN DAM FAILURE NEEDED.

There have been so many differences in the opinions of experts who have examined the ruins of the dam at Austin, Pa., and there are so many questions of the utmost importance to engineers raised by the discussions of the matter that it seems desirable that a most thorough and disinterested examination of the structure and of the other facts in the case be made before the elements have removed any material part of the evidence. Most properly this investigation would be made by the State of Pennsylvania, but if this cannot be brought about promptly, some association, such as the American Society of Civil Engineers, which has money enough at command to pay the possibly large expense should take it up.

The earlier evidence in the case indicated that the failure was due to slippage of the dam on its base or of one stratum of the base on another, with subsequent erroneous treatment of the case and a later slippage which caused the disaster. This is the opinion expressed by Prof. F. P. McKibben, an expert for the district attorney at the coroner's inquest, who presents evidence to the effect both as to actual occurrences

at the time of the failure, and, in his opinion, errors in design, since the base was merely level and not stepped and was not carried deep enough to prevent sliding or percolation of water under the dam, also errors in construction, since large smooth joints passed horizontally through the dam, due to lait ance.

Walter H. Sawyer, consulting engineer, Lewiston, Me., reports in *Engineering Record* the results of his independent investigations for his own purposes. He does not accept the theory that any part of the ledge on which the dam rested moved down stream and attributes the entire movement to sliding of portions of the dam on other portions at the horizontal joints produced by the laitance at planes between deposits of concrete in the construction.

Alfred D. Flinn, of the New York Board of Water Supply, in his evidence before the coroner follows more in detail the line of Prof. McKibben but shows some of the difficulties attending the examination and some of the evidence which could not be obtained with the means of examination at hand. Mr. Sawyer also recognizes the fact that not all the evidence is readily visible and he recommends the detailed investigation with sufficient funds to make it complete. MUNICIPAL ENGINEERING wishes to add its vote to this proposal and trusts that the duty will be accepted by some organization, preferably the State with the American Society of Civil Engineers as second choice.

THE QUESTION DEPARTMENT

Who Should be Assessed for Sidewalk Within Street Intersection Area?

There is a question in this city who is to pay for the corner of sidewalk and curb as per enclosed diagram.

J. U., Port Washington, Wis.

The diagram asks who must pay for the rectangle of sidewalk at a street corner which does not abut on the lot but corners on it. This question is quite fully discussed in MUNICIPAL ENGINEERING, vol. xxvi, p. 25, as to sidewalks, and in vol. xxxviii, p. 110, as to street intersections. Other articles having some bearing on the case will be found in vol. xxviii, p. 102; vol. xxiv, pp. 369 and 384; vol. xxii, p. 21; vol. xvi, p. 398.

The question is one which should be referred to the city attorney, who is presumably familiar with the statutes of the state. In some states he sidewalks are considered to be the property of the owners of the abutting property, while in others, the sidewalk is a part of the area of the highway and the cost of improvement is assessed in the same way as that of improving the street driveway. In such cases the assessment for the intersection may be spread over the property on the block or may be paid by the city as the law and the custom in the city determine.

Street Grades in Small Cities.

This city has under consideration the passing of an ordinance regulating street sections and grades for curb and gutter. Quite a good deal of cement curb and gutter has been built this season. Much more is now being contemplated. The grades of our streets vary from zero to ten per cent. None of our streets are paved. Sidewalks are being built to grades which were established some thirteen years ago. In fixing these grades at street corners no general rule seems to have been followed other than by taking levels at the natural surface or on the old tar walks and calling that "grade." Hence it is impossible in many cases to give a grade for curbing that will shed the water toward the street and I have so far been unable to find any general rule for giving such grades that will fit even the majority of our street crossings. The standard texts on roads and pavements give plenty of information regarding street sections where the grades are or can be made theoretically correct, but the fellow is left in darkness who is trying to get the best results out of the existing conditions in an old town.

Any information you can give us along the lines above mentioned will be appreciated.

L. ———, Ill.

This question is one which is theoretically easy but practically any general system must be modified to suit local conditions. Articles in recent numbers of MUNICIPAL ENGINEERING which have a bearing on the subject are as follows:

In vol. xli (current): "Drainage for Flat Streets," p. 46; "Breaking Grades of Streets on Hills," p. 47; "The Right to Change Street Grades for Public Necessity," p. 55.

In vol. xl: "Form of Grade Book for Small City," p. 210; "Street and Sewer Designs for New City," p. 43.

In vol. xxxix: "Damages and Benefits for Changing Street Grades," pp. 216, 217; "Sidewalk and Curb Grades," p. 354, which goes into considerable detail as to methods of treating various special cases.

In vol. xxxviii: "The Care of Surface Water at Street Intersections," p. 11.

In vol. xxxvii: "Damages for Change of Grade," p. 117; "Establishing Grades for Streets, Sidewalks and Curbs," pp. 181 and 256, giving references to other articles on the subjects in previous volumes; "Some Examples of Street Design," p. 307; "Ordinances Concerning Sidewalks," p. 328; "Change to Establish Grade of Street," p. 337; "Storm Drainage at Street Intersections," p. 374.

These articles discuss most of the points to be considered in working out an answer to the question, from one point of view or another. It would not be possible to make an answer directly applicable to the particular case without detailed knowledge of the special circumstances and actual inspection of the ground with this knowledge in hand.

As regards the sidewalks, there should be full information as to the legality and finality of the grades already established, the damages that may accrue from change of the established grades, the cost of reconstructing sidewalks set to these grades, the possibility of draining the sidewalks elsewhere than to the gutters.

As regards the streets, there should be information as to the width between curbs, the modern and most commendable tendency being toward narrow driveways, not to exceed thirty feet between curbs unless there is a street car or interurban line on the street. This means a wide lawn in many Illinois towns with consequent increase in necessary height of sidewalk above the gutter in order to drain water across the lawn to the gutter. Again, it is customary in grading city streets in a level country to cut the area between curbs down well below the lawns and sidewalks. This excavation must be made to

some extent to give room for the foundation under the pavement, and can well be carried a little deeper, with material improvement in the appearance of the street as well as in facilities for drainage. When a street is perfectly level, sufficient grade can be given to the gutters to carry off water by properly excavating the subgrade so as to give the necessary fall, even if the center of the street is left nearly level. If the storm water from the street is to be taken off by sewers or underground drains with inlets at the street corners and other convenient places, the problem is easier than if the water must be carried off over the surface, for in the latter case the gutters must be high enough at the corners of the streets to allow for the proper treatment of the channels across the streets, and this makes the connections with sidewalks already laid at too low a grade more difficult, and often impossible, without relaying the sidewalks.

As to the gutters, in addition to what is said above, it is possible on wide streets to take care of them at the street corners by setting them lower than the center lines of the streets, thus making the crowns of the streets greater, which is an improvement at the intersection of two wide streets, and sometimes by running the water channels underground for short distances in the lawns and across the streets. The latter is seldom possible, however, in a town where streets are nearly level.

Enough has been said to show that it is not possible to solve such a problem by any text book methods, although they may be used to advantage in working out a proper solution. In some cases it may be necessary to reconstruct the sidewalks or even fill the abutting lots, but usually, if the property can stand the expense, which is really quite slight, it is better to excavate the roadway and set its surface low enough to take care of the drainage from the whole surface of sidewalks. lawns and roadway. This means a carefully designed system of grades for the whole town and the construction of the streets, or at least of the drainage channels, beginning at the stream which serves as the outlet, and working up the lines so that there will never be a low corner without an outlet to which water drains without hope of escape except by flooding the whole roadway.

Remedy for Overprinted BluePrints.

I note the request in the November issue of W. H. R., Kelso, Wash., asking for a remedy for burned or over-printed blueprints, and would state that a better remedy for this than that suggested is ordinary peroxide of hydrogen.

W. L. HAIN,
Warsaw, N. Y.

Explanation of Sewer Computation Diagram.

Would you please undertake to explain Mr. Geo. S. Piersons' Graphical Sewer Chart through your Question Department. Mr. Pierson gives an example but does not finish it, and I fail to grasp use or application.

M, ———, Ill.

The example given by Mr. Pierson reads as follows:

Required: The size of outfall necessary to discharge the sewage of 12,500 lineal feet of tributary lateral sewers, allowing ten persons for each lot of 25 feet front and 75 gallons per diem per capita.

The diagram is in three parts to solve the three problems presented, so arranged that the result from the first diagram is properly located to be used in the second and the second result in the third diagram.. The first part, entered with the lineal feet of sewer on the left and the number of persons tributary to 100 feet of sewer at the top, gives the tributary population on the right, the description of the example reading as follows:

Starting at the left hand column in the diagram at 12,500 lineal feet, follow the diagonal line upward and to the right to the vertical line of 80 persons per 100 feet of sewer, thence horizontally to the right across the column of Tributary Population (which is determined to be 10,000).

The second part, entered with this tributary population on the left and the gallons of sewage per diem per capita at the top, gives the total discharge in gallons per diem, and the description of the example continues, starting with the 10,000 population,—

Thence diagonally upwards and to the right to the vertical line of 75 gallons, thence horizonally to the right, when we note that the total daily discharge will be 750,000 gallons and that it will require a sewer of 15 inches diameter, 0.26 per 100 grade; 12 inches diameter, 0.75 per 100 grade; or, 10 inches diameter, 1.88 per 100 grade.

Probably our correspondent is confused because the description of the example does not continue in the same manner as for the other two diagrams.

The third diagram entered with the total gallons per diem on the left and the fall in the sewer in 100 feet at the top gives the diameter of the sewer by Latham's formula of by Kutter's formula, and the velocity of flow in the sewer, but not in exactly the same way. The description of the example in the third diagram might be continued to read as follows:

The intersection of the horizontal line for 750,000 gallons per diem and the curved black lines for diameter of sewer 15 inches is at the point of 0.26 on the scale of Fall in 100 at the top, indicating that if a 15-inch size is chosen for the sewer the fall per 100 feet must be 0.26. In like manner the intersection of the 750,000 gallon line with the 12-inch sewer curve shows a necessary fall of 0.75 per 100 and that with the 10-inch sewer line a fall of 1.88 feet per 100 feet. The fall available will determine which of these sizes of pipe must be used. If Kutters' formula is used the curve in red must be used and show heavier falls necessary for the same sizes of pipe.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Best Pavement for Steep Grades.

I notice an inquiry in a recent issue of MUNICIPAL ENGINEERING regarding the best pavement for steep grades. I believe your readers will be interested to know that the first bitulithic pavement laid in Boston is on Hancock street, having nine per cent. grade, the pavement having been laid in the spring of 1902, and having given excellent satisfaction, and is still in first-class condition.

Prior to the laying of bitulithic, this street was macadamized and gave a great deal of trouble, owing to the washing out of the macadam during heavy rain-falls.

JAMES H. SULLIVAN,
Division Engineer, Highway Division, Public Works Department, Boston, Mass.

Cost of Engineering on Good Roads.

Supplementing your answer to "C. E."'s

To the Editor of MUNICIPAL ENGINEERING:

Sir—Supplementing your answer to "C. E."'s inquiry as to the cost of engineering on good roads (October, 1911, p. 290), the following data, clipped from the Dallas News of February 14, 1910, may be of interest. The figures are from a table of expenditures of county road money in Dallas county, Texas.

Total expenditures up to September 5, 1909	$267,310.58
Included in this is engineering...	20,012.56
Total expenditures September 5, 1905, to January 1, 1907	408,605.13
Included in this is engineering...	27,834.54

The cost of the engineering was 7.49 and 6.81 per cent. of the total expenditure.

H. V. HINCKLEY, Consulting Engineer.
Oklahoma City, Okla.

Screened vs. Pit-Run Gravel.

With the possible exception of a few cases, such as urging some home remedy for the croup or prescribing "rock and rye" for a cold, few sane persons will attempt to give the doctor pointers on his profession. Yet "practical men" and "public-spirited citizens" consider it their right and their bounden duty to indicate to the engineer the error of his way and to offer suggestions relative to the practice of his profession. This attitude is always particularly noticeable when a change or a rigid enforcement of specifications is the point under discussion. The following item, clipped from a Peoria paper, is indicative of this tendency:

For the first time in the history of paving operations in Peoria screened gravel was used this morning in making the concrete for the foundation. Hitherto nothing but pit-run gravel has been used, and the innovation comes in the paving of Frank in street.

City Engineer Canterbury states that hereafter all paving specifications will call for screened gravel, and this ruling has caused much dissatisfaction among paving contractors and property owners who will be called upon to pay for the coming street improvements. The difference in cost between screened and pit-run gravel is about 25 per cent., and this alone will increase the cost of the proposed paving of Elizabeth street, from Chambers avenue to the Knoxville road, in the sum of $4,600.

Paving contractors and cement workers are agreed in the expressed opinion that the substitution of screened gravel for pit-run gravel is the rankest folly. Sand is an essential component in the formation of concrete, and if screened gravel is used the sand is to be added to make a compact foundation. In the pit-run gravel the sand is already there, and therefore it is regarded as sublime idiocy to screen the sand out of the gravel and then put it back when the concrete is made, to say nothing of the extra cost involved.

These facts are being brought before the board of local improvements at its meeting this afternoon, in the endeavor to induce it to insist that in drawing up its specifications for street paving the city engineer return again to pit-run gravel in the interest of common sense and economy.

H. Y. CARSON, Danville, Ill.

Electrolytic Treatment of Sewage at Oklahoma City.

The electrolytic system of sewage disposal at Deep Fork, near the country club, as installed by A. J. McMahan, was accepted by the board of city commissioners as the official system for the city.

This system has undergone thorough tests by the city and state bacteriologists and the report of the city bacteriologist showed that one trough eliminated 99.75 per cent. of the disease germs and the other 99.82 per cent. The state bacteriologist's test taken at a different time showed that the two troughs

eliminated 98.5 and 98.4 respectively.—*Oklahoma News.*

To the Editor of MUNICIPAL ENGINEERING:

Sir—We are advised that the above is the result of a six months' test of the electrolytic treatment of sewage—first tried at Santa Monica more than three years ago. The Santa Monica plant after a three years test has been doubled in capacity to take care of a greater population. The Oklahoma City plant discharges its effluent into a dry gulch and the six months covered by the test has been the driest for many years. The adoption of the electrolytic as the official sewage treatment for the city means more plants for Packingtown and the business district at an early date. H. V. H.

The Effect of Public Service Commissions Upon Securities Operating Thereunder.

The following from the "Readers' Investment Bureau" of the *Review of Reviews,* which advises inquirers regarding investments is of interest in connection with the editorials on the above subject in MUNICIPAL ENGINEERING, vol. xl, p. 425, and on another page of this issue:

By public service corporations we mean corporations engaged in the business of supplying transit facilities, water, gas, electricity and power to the inhabitants of the various communities. Securities of corporations engaged in a business of this kind in the State of Wisconsin have an excellent standing for the reason that such corporations are regulated by one of the most comprehensive laws to be found on the statute book of any of the states. New York and Massachusetts are the only States we can recall at the moment which have laws on the same plane of efficiency as those of Wisconsin in this respect.

Reinforcing Wooden Poles with Concrete.

The overhead department of the Indiana Union Traction Company, Anderson, Ind., this year is reinforcing about 1,600 of its trolley poles. Last year about 700 poles were reinforced and during the late fall of 1909 similar work was done on 250 to 300 poles. The method employed is, briefly, as follows:

An excavation to a depth of 24 in. to 28 in. is first made around the pole. The rot around its base is then shaved off and a thorough application of creosote is given the pole from the bottom up to a height of 3 ft. or 4 ft. above the ground. For installing the concrete reinforcement thirty-six forms, 48 in. long and ranging in diameter from 18 in. to 24 in., are used. These are constructed of black sheet iron and are made in semi-circular halves. Semi-circular bands are riveted to the iron to hold the forms in shape, the edges of the forms being hinged together, thus permitting easy handling and assuring that halves of the same size are kept together. With thirty-six forms four men can be kept busy concreting.

A form of the size most nearly conforming to the size of the pole is laid around it, and inside this form is placed wire reinforcement consisting of 46-in. twelve-bar heavy wire fence, with No. 7 top and bottom wires, No. 9 intermediate horizontal wires and No. 9 vertical wires spaced 3 in. apart. This fencing is cut in lengths sufficient to encircle the pole and be embedded in the concrete just inside the forms. The form is then filled with concrete consisting of one part cement to five parts gravel and sand. The top is sloped off slightly to assist in shedding water from the top of the concrete and around the pole. The form is removed from the pole after about twenty-four to thirty-six hours. After the forms have been removed the dirt is tamped in around the concrete and the pole is coated with a heavy paint or pitch compound around the top of the concrete to eliminate as nearly as possible the entrance of moisture between the concrete form and the pole.

The reinforcement is being applied to 30-ft. and 40-ft. poles, although the latter size poles are thought to be good for a considerable length of time. The 30-ft. poles, however, are believed to be near the maximum limit of their life without some form of protection and therefore reinforcement, as described, has been applied.

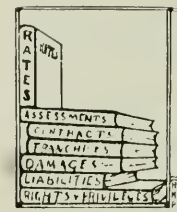
G. H. Kelsey, superintendent of power, has charge of the work and devised the above method.

Paving in Mason City, Iowa.

A total of thirty-one blocks of pavement, all of it cement, was laid by Mason City this season according to figures of the engineering department. The total cost of the cement pavement was $14,850, or an average of $1.35 per square yard. The city now has 110 blocks of pavement, or a little more than six and one-fourth miles. The total cost of the cement pavement as laid is $70,200 for fifty-two blocks; for brick pavement, $70,560 for thirty-six blocks; for asphalt, $21,830 for seventeen blocks; and $11,750 for five blocks of creosote blocks. The cost per yard for the cement was $1.35; for brick, $1.96; for asphalt, 89c, and for creosote block, $2.35. The asphalt and creosote blocks were laid some years ago.

The Municipal Power Plant of Winnipeg, Canada.

Winnipeg's civic power plant was put in operation in October and current for lighting was successfully transmitted from the big Point du Bois station on the Winnipeg river. The city is enabled to do its own lighting and is rounding into shape to serve a long list of customers who have signed contracts to use civic light and power at prices much below those that have prevailed in the city heretofore.



MUNICIPAL MATTERS IN COURT

Higher Courts.—Damages for Illegal Use of Roads.—Milwaukee's Free Legal Bureau.

Decisions of the Higher Courts of Interest to Municipalities.

Extras Must be Paid When Provided in Contract.—A provision in a contract to construct a bridge that a specified sum is to be in full compensation for the cost of the entire work, and that the city shall not be liable for extras of any kind, is modified by a subsequent provision authorizing additional compensation for extra work in making the excavations for piers and abutments on encountering material different from that disclosed by the borings forming a part of the plans, and the contractor by complying with tation of claims may recover for such work. Capital City Brick and Pipe Co. v. City of the provisions of the contract as to presen- Des Moines (Iowa), 132 N. W. 188.

Paving Company Not Liable for Damages Due to Unrepaired Pavement.—A contract by a paving company with a city provided that it would construct pavement in a good manner and maintain it in good condition for five years, and that "during the performance of the work * * * will place proper guards around * * * the same to prevent accidents and * * * keep suitable lights and save the city harmless against suits for damages," and also provided by another clause that it would repair and make good to the satisfaction of the engineer any cracks or depressions which should occur within five years from acceptance and when notified by the president, and that the contractor would, within five days of the receipt of notice, restore the pavement over all opening made by corporations. *Held*, that where a telegraph company within the five years opened a portion of the pavement, and the paving company after notice failed to restore it, and an accident occurred and the city was sued for injuries, the paving company was not liable to the city. City of New York v. Sicilian Asphalt Paving Co. et al (N. Y.), 130 N. Y. S. 468.

Owner Not Liable for Water Rental of a Tenant.—The charge made by the city of New York for water furnished through a meter is not a tax, but a contract obligation between the city and the actual consumer who is the principal debtor, though City Charter of Greater New York imposes a lien on the premises as security for the payment thereof; the relation of the owner to a charge for water furnished to another occupying the premises being that of surety. Rankin v. City of New York (N. Y.), 130 N. Y. S. 427.

Councilman Ousted for Cause May be Reelected.—Where, being ousted from office by decree of court, because a stockholder in a corporation furnishing supplies to the borough, a borough councilman immediately sells his stock, resigns his office, and is reelected by the council, the council having authority to fill vacancies in its body, all these actions being taken bona fide, he has a colorable title and becomes and continues a councilman de facto till a decree for a second ouster, and in the meantime his votes and acts are forceful and binding, where public interests are concerned. Warren et al v. Coatesville Borough et al (Pa.), 80 A. 576.

Regulations to Prevent Water Waste Are Reasonable.—Regulations for municipal water service to individuals, prohibiting use of hose, rams, syphons, etc., except when the premises are metered, requiring consumers to keep pipes in repairs and to prevent waste, etc., are reasonable. Johnson-Kahn Co. v. Thompson et al (N. Y.), 130 N. Y. S. 216.

Private Water Company May Be Taxed to Support a Municipal Plant.—A water company holding a franchise to operate its system within a portion only of the limits of a village is subject to taxation of its property located within the village for the purpose of paying bonds issued and expenses incurred for the maintenance of a municipal water system installed subsequently to that of the water company. When a municipal corporation is created the power of taxation is vested in it as an essential attribute for all the purposes of its existence, unless its exercise be in express terms prohibited.—Beauty Springs Water Co. v. Village of Lyons Falls (N. Y.), 130 N. Y. S. 875.

City Liable for Negligence of Its Contractors. Though a city might not be liable for injuries by obstructions on a sidewalk placed there by other than the city's agencies, because the board of police commissioners had sole authority to abate such nuisances, the rule would not apply where the obstruction was placed in the street by the city's contractors over which it had con-

trol. Where the agreement between a city and contractors putting in a sewer required the work to be done under the supervision of the city engineer, with whose directions the contractors were required to comply, the contractors were not independent contractors, so as to relieve the city from liability for injuries to a pedestrian by falling over a manhole frame temporarily placed by the contractors on the sidewalk.—McCarthy et al. v. Clark (Md.), 81 A. R. 12.

Contractor Not Responsible for Injuries if Warning Signs Are Stolen.—Where, in an action against a city and sewer contractors for injuries by falling over a manhole frame temporarily placed on a sidewalk by the contractors, the pleadings and evidence raised the question of negligence in placing the frame on the sidewalk as well as in not having it lighted, a requested prayer was properly refused that, if the contractors had a light placed on the manhole frame which was removed without their knowledge, they were not negligent; such prayer ignoring the other questions of negligence.—McCarthy et al. v. Clarke (Md.), 81 A. R. 12.

Damages on Condemnation Proceedings Must Be Prepaid.—Under the act which provides that a municipal corporation having the power of eminent domain shall make just compensation to be ascertained by law for the property taken, injured or destroyed, by the construction of its highways, which compensation shall be paid before such taking, injury or destruction, and which, after securing the right of appeal and the right to have damages determined by the jury, provides that such appeal shall not deprive one who has obtained a judgment of condemnation of a right of entry, provided the damages assessed shall have been paid into court in money, the rights of an owner who files a bill to enjoin a street grade improvement until he should be compensated for the injury to his abutting property are protected by an order of reference to ascertain full indemnity to the owner and costs, and a deposit with the register of the amount so ascertained to abide the result of the suit.—Stocks v. City of Gadsden (Ala.), 56 S. R. 138.

Municipality Is Liable for Damage Due to Diverted Water.—When a municipality in the improvement of its streets diverts water from its natural channel so that it passes over and injures land which it did not injure before the construction of the improvement, the municipality is liable.—City of Jasper v. Barton (Ala.), 56 S. R. 42.

Petition Necessary Before Street Grade Is Changed.—Since under an act providing that no change of an established street grade shall be ordered by city council, except on petition of the owners of a majority of the property affected by the proposed change, a petition for such change, signed by the requisite number of competent property owners, is a condition precedent to the making of an order for a change, and the city council has no power to order a change until a sufficient petition is filed, and since such an improvement directly affects private property, an order of the council directing the improvement was not a conclusive adjudication that a sufficient petition had been filed, there being nothing in the staute giving the order such effect, so that, if the petition was not sufficient to confer jurisdiction, it was subject to collateral attack in any action involving the validity of the proceedings.—Wilcox v. Engebretson et al. (Ca'.), 116 P. R. 750.

Contractor's Cook Is Not Connected with Work.—A certain act provides that a contract made expressly for the benefit of a third person may be enforced by him. A contractor with a city for the construction of a tunnel agreed to protect it from "all claims and liens of any kind whatsoever connected with said work," and authorized the city to withhold money due by him to his laborers or other workmen. Held, that a cook for the laborers engaged in the construction of the tunnel was not "connected with said work" and could not enforce the provisions of the contract as against the contractor.—Clark et al. v. Beyale et al. (Cal.), 116 P. R. 739.

Board of Appraisal Is not Entitled to Compensation for Dilatory Work.—As the commissioners of appraisal engaged in estimating the value of land condemned by the board of water supply had power to organize its business and insist upon punctual attendance by parties and prompt submission of the evidence under the penalty that follows default, they are not entitled to compensation upon the scale of full days, where they allowed the proceedings to drag along, and the sessions lasted only a few hours each day.—In re Simmons et al. Board of Water Supply (N. Y.), 130 N. Y. S. 773.

Fire Damages Cannot Be Obtained on Basis of Low Water Pressure.—A property-owner and taxpayer in a city has no right of action against a water company on its contract to furnish water to the city at public hydrants, for fire purposes, a pressure of 150 pounds and a sufficient supply of water for a certain length of time, for damages to his property by fire occasioned by the company's failure to furnish pressure and supply of water as it had contracted, since there is no privity of contract between such owner and the water company which will allow him to sue for a breach of the contract with the city.—Collier et al. v. Newport Water, Light and Power Co. (Ark.), 139 S. W. R. 635.

Right to Purchase and Renewal Privilege of a Franchise Constitute Alternative Courses of Action.—The city of Denver, by an ordinance which was accepted and under which the company expended several million dollars, granted a franchise to a water company for 20 years, the limit of its power,

and also contracted to pay for the maintenance of fire hydrants. The ordinance provided that at the expiration of the term the city should have the right at its election to purchase the property of the company, its value to be appraised in case of disagreement, the company's franchise to then cease. By a following provision the city was given the right at its election to renew the franchise of the company at the end of the term for another 20 years with a reduced rental for its hydrants. Held, that, in view of the nature of the business for which the franchise was granted, the shortness of the term, and the large expenditures which must necessarily be made and continued through the term to give adequate service in a young and rapidly growing city, such two provisions of the ordinance contract should be construed together as requiring the city to purchase the property at the end of the term, if it did not renew the franchise; it not having power to bind itself by a contract to renew, but having power under the statute to contract to purchase if it should choose not to renew.—City and County of Denver et al. v. New York Trust Co. et al. Same v. Denver Union Water Co. (Colo.), 187 F. R. 890.

City Must Maintain Adequate Channel for Water Supply.—Where a city diverts a stream of water from its natural channel and undertakes to convey the same by means of an artificial channel or canal, it should be held liable for the exercise of reasonable care and diligence in constructing a channel of sufficient size to carry the volume of water that may be reasonably anticipated or expected to flow down the same and for the maintenance of the same in a reasonably safe condition.—Wilson v. Boise City (Idaho), 117 P. R. 115.

City Is Not Exempt from Damages Due to Exceptional Natural Causes.—A municipality will not be exempt from liability for damages on account of failure to maintain a sufficient artificial channel to carry off the water of a stream that it has diverted from its natural channel, merely on the grounds that the flooding and overflow was caused by an unusually heavy rainfall or cloudburst, the like of which has not usually occurred, where it appears that a number of such rainfalls or cloudbursts have occurred in the same locality within the last preceding 15 or 20 years.—Wilson v. Boise City (Idaho), 117 P. R. 115.

Distribution of Cost of Public Improvements Must Be Determined by Municipal Officers—Whether the cost of a public improvement shall be borne wholly by the property benefited, wholly by the public, or in part by each, are questions for the municipal officers, whose determination the courts cannot control. The determination of assessing officers as to the amount assessed upon specific tracts for public improvements is ordinarily conclusive upon the courts and will not be disturbed unless the assessment is so disproportionate to the benefits as to amount to confiscation.—Powell v. City of Walla Walla (Wash.), 117 P. R. 389.

Bond Election Void if Different Questions Are Not Separately Stated.—An ordinance which states the purpose of a proposed issue of municipal bonds as follows: "That it is the purpose and intention of the chairman and board of trustees of the village of Salmon City to incur such indebtedness and issue such bonds in the total amount of fifty thousand ($50,000) dollars, thirty thousand ($30,000) dollars of which amount shall be used for the purchase of the waterworks, water rights, system and franchises of the Salmon City Water Company, Limited, and that an amount not to exceed the sum of fifteen thousand ($15,000) dollars of such indebtedness and bonds shall be used to enlarge and extend the said waterworks and water system, and an amount not to exceed the sum of five thousand ($5,000) dollars shall be used for the purchase, erection, construction and furnishing of a public building and building site for the use of such village," states two separate and distinct purposes and questions, and the ballot used at the election which requires the voter to designate thereon his vote either for or against the single proposition of favoring or disapproving the issue of the aggregate amount of the bonds proposed does not give the voter an opportunity of expressing his will upon each of the purposes and questions incorporated in the ordinance.—Estrander v. City of Salmon (Idaho), 117 P. R. 692.

City Must Not Protect Grass Plots by Injurious Barriers.—While a city could protect grass plots along sidewalks by suitable barriers, it was negligent in stretching a small, dark wire on stakes about a foot from the ground, along the edge of the grass plot; such wire being calculated to cause injury to pedestrians rightfully attempting to cross the plot.—City of Paducah v. Simmons (Ky.), 139 S. W. R. 851.

City Responsible for Assessed Improvement Work.—Where a contract for the paving and grading of streets provides that the fund for the payment of the contract price is to be derived from assessments on the property benefited, and that the city is to be liable only for the amounts actually collected from the assessments as they are collected, but the city delays for four years and more after the completion of the work to make collections, it is liable for the contract price out of its general funds, though it has filed liens and issued writs of scire facias within the time prescribed by law. Where a contract for the paving and grading of streets provides that the fund for the payment of the contract price is to be derived from assessments, but after a delay of more than four years in making collections the contractor sues the city, he is entitled to interest from the completion of the work, and not from the

date from which interest accrued on the assessments.—Dale et al. v. City of Scranton (Pa.), 80 A. R. 1110.

Collection of Damages for Improper Use of a Highway.

In a decision recently rendered by the Court of Appeals of Kentucky (Commonwealth v. Prall, 139 S. W. R. 798) it was held that one who materially damages a road by unusual use must repair it; further stating that he was guilty of obstructing the road and could be fined for failure to make the needed repairs.

The road in question is known as the Bardstown & Bloomfield Turnpike, and it is a macadamized road; that is, constructed of Telford paving, with crushed or knapped stone on top. The unusual use made of it, as shown by the evidence of the commonwealth, was in hauling over it, from a point nine miles east of Bardstown to the railroad station at the latter place, in wet weather and during thaws, wagons containing loads of extraordinary size and weight, consisting of large sawlogs, in many instance as many as six to the load. According to further evidence of the commonwealth, no other loads of such size or weight were ever hauled over this turnpike, and their unusual and unnecessary weight, together with the unseasonableness of the weather, rottenness of the ground and reckless driving of servants in charge of the wagons and teams, caused the turnpike to be torn up in places and much of its Telford paving and top metal to be displaced, thereby producing holes and ruts in the roadbed, some of them as much as 6 and 12 inches in depth; these conditions being particularly prevalent on hilly parts of the turnpike, where teams in going down the grades, were unable, on account of the great weight of the loaded wagons, to hold them back, and were allowed by the drivers to run the wheels of the wagons on and over the edges of the turnpike, thereby removing and destroying its curbstones. There can be little doubt that if the foregoing injuries resulted to the turnpike from unusual and unnecessary use of it, as shown by the evidence, it materially damaged it in fact and in the meaning of the statute. Indeed, the evidence introduced did not materially refute this fact, but was mainly directed toward showing that the damage caused to the pike was not as great as stated by the commonwealth's witnesses, and that injury also resulted to the turnpike from the wagons of others.

It was, however, stated that in a proceeding to recover a fine for damaging a highway by its unusual use in hauling and refusing to repair it, evidence was not admissible that hauling by others also damaged the road, if it did not show that the particular damage alleged in the petition was caused by such other hauling.

Free Legal Aid in Milwaukee.

A report has been submitted by a bureau appointed by Mayor Emil Seidel, of Milwaukee, to investigate the question of free legal aid. A bill before the Wisconsin Legislature failed of passage, but the organization of a voluntary bureau similar to those of New York and Chicago is urged.

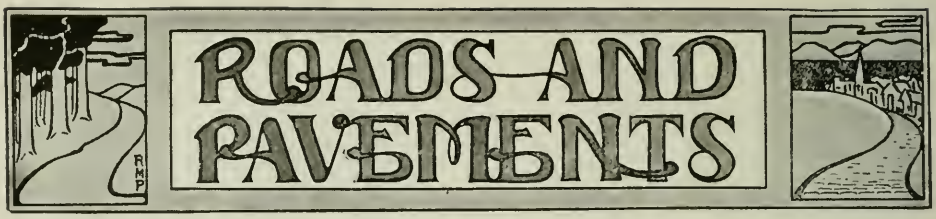
In spite of the fact that Milwaukee has a population of 370,000, the majority of whom are wage earners, the city has no organized free legal service for persons unable to hire an attorney. A precedent for this form of public service is found in New York, Chicago, Philadelphia and several other cities where the "poor man's lawyer," supported by a private charitable society, has already become an established institution; and in Kansas City, where the advanced step of maintaining a legal aid bureau as a regular part of its city administration has recently been taken.

The method of operating these bureaus is practically the same whether under private or public management. One or more lawyers, serving on salary, are placed in charge and are given assistants who act as paid investigators to inquire into the circumstances brought out by an office interview with the applicant.. In addition, occasional legal advice is rendered by attorneys who serve without pay. In Kansas City, six city attorneys each give two hours of their time during a single week. In the work of the private societies a small fee is charged. The Philadelphia society requires the applicant to pay 25 cents as a retainer, if possible, as well as the costs of any proceeding, and collects 10 per cent as a contingent fee in all cases where the amount recovered is over $10.

Failure to obtain justice in some cases is urged as a reason for free legal aid and a radical change in court procedure, such as the frequently advocated establishment of a system of public defense conducted on lines similar to present public prosecution, is recommended by the report.

Corporation Fined for Obstructing River.

The Great Lakes Dredge and Dock Company was recently fined in the sum of $2,500 for dumping debris into the Chicago river. According to the evidence, the Great Lakes Dredge and Dock Company had a contract to build docks for Albert Pick & Co. at Thirty-fifth street and the south fork of the river. Much excavating was done, and, instead of carrying the debris away, as is required by law, the company dumped it into the riaer, filling up the stream so that navigation was impossible. In March government inspectors warned employes of the dock company whom they found shoveling dirt into the river, and later a suit was brought against the company with the result above stated.



Highway Laws of Pennsylvania.—Rochester's Street Improvement.—Road Progress.

Highway Laws of Pennsylvania.

In a paper presented before the convention of the American Road Builders' Association, in Rochester, N. Y., on November 14 to 17, Jos. W. Hunter, Assistant Commissioner of Highways of Pennsylvania, gave a resume of the highway laws of the State. The following abstract gives the main points of this paper:

The laws governing the public highways of Pennsylvania followed the old English laws of George III, which, in turn, were a consolidation of the old Roman law and of the statutes of Henry VIII and of Philip and Mary. The act of the General Assembly of 1836 consolidated all other acts and became the general law governing the highways of the State until the passage of the highway act of April 15, 1903, which was reenacted with amendments by the act of assembly approved May 1, 1901, which act created the State Highway Department, under which the work of reconstructing township roads with the co-operation of townships and counties, was inaugurated and carried on. The initiative of all State aid work under this law was with the township, and until a township made an application asking for State aid in reconstructing a road no work could be done by the department. After a road had been reconstructed the maintenance of said road was placed on the township, and as a consequence the roads were not maintained. Under this system of State aid 850 miles of township roads have been reconstructed. The act of Assembly, approved April 12, 1905, supplemented by the act of June 14, 1911, changed, in a great measure, the system of maintaining the earth roads in the State, placing them in a great measure under the care and supervision of the State Highway Department. This law provides for the abolishing of the road work tax absolutely and places all the townships on a cash road tax basis, the State agreeing to pay a bonus of 50 per centum of the amount of cash raised by a township, provided, however, that the money appropriated by the State shall be expended by the townships in permanent improvement under the supervision of the State Hfghway Department. The department is to furnish plans for bridges, culverts and make surveys and plans for changes of grade and to supervise the work without cost or charge to the township in which the improvement is being made.

The acts of 1903 and 1905, with their supplements and amendments, were repealed and the State Highway Department was reorganized by the act of May 31, 1911, which act authorizes a system of state highways to be constructed and maintained at the sole expense of the commonwealth, and also a system of State aid highways, in the construction of which the State co-operates with the counties and townships, and in certain instances with boroughs, the State paying 50 per cent. and the county and township each 25 per cent. of the cost. The State will maintain all State aid roads and collect 50 per cent. of the cost thereof from the respective township or borough in which the road may lie.

The State Highway Commissioner is appointed by the Governor with the advice and consent of the Senate, for a term of four years. He gives bond in the sum of fifty thousand dollars for the faithful performance of his duty and appoints as an assistant to the chief engineer an engineer of bridges, who shall be a capable and competent civil engineer, experienced in the designing and construction of bridges; he also appoints fifteen civil engineers; he also appoints a chief draughtsman, who shall be a civil engineer, four assistant draughtsmen, a chief clerk, eight additional clerks and stenographers, two bookkeepers and such other additional clerks and stenographers as the work of the department requires. He also appoints fifty superintendents of highways. The Governor appoints two deputy highway commissioners, to be known as First Deputy State Highway Commissioner and Second Deputy State Highway Commissioner, respectively, one of whom shall be a competent civil engineer. They each give bond in the sum of twenty-five thousand dollars. They are subject at all times to the authority of the State Highway Commissioner; he also appoints an auditor for the said department, who shall be a certified public accountant: he gives bond in the sum of

twenty-five thousand dollars. The Governor also appoints a chief engineer of the department, who shall be a capable and competent civil engineer and experienced in the building and maintenance of improved roads.

The new highways act provides for the taking over by the State Highway Department on or before June 1, 1912, of 7,900 miles of township roads, as described in 296 routes, to be known and designated as state highways and, when so taken over, shall thereafter be constructed, improved and maintained by the State Highway Department at the expense of the commonwealth; this taking over, however, will not include any portion of a turnpike which at the present time is a toll road. These toll roads will not be taken over until after the money becomes available from the proposed bond issue. This proposed bond issue will be in the form of an amendment to Article IX of the State Constitution, Section 4, which reads as follows:

"Section 4. No debt shall be created by or on behalf of the State except to supply casual deficiencies of revenue, repel invasion, suppress insurrection, defend the State in war, or to pay existing debt; and the debt created to supply deficiency in revenue shall never exceed in the aggregate, at any one time, one million dollars."

And which, when amended, will read as follows:

"Section b. No debt shall be created by or on behalf of the State except to supply casual deficiencies of revenue, repel invasion, suppress insurrection, defend the State in war, or to pay existing debt, and the debt created to supply deficiencies in revenue shall never exceed in the aggregate, at any one time, one million dollars: Provided, however, that the General Assembly, irrespective of any debt, may authorize the State to issue bonds to the amount of fifty millions of dollars for the purpose of improving and rebuilding the highways of the commonwealth."

This resolution will again be before the Legislature for action at the session of 1913, and if again approved by that body will come before the citizens for ratification or rejection by them at the next state election, and if ratified by the people, then the General Assembly may authorize the State to issue bonds to the amount of fifty million dollars for the purpose of improving and rebuilding the highways of the commonwealth. Until the money from the bond issue becomes available, the amount of work to be done by the State Highway Department in the reconstruction of state highways will be limited and confined to the appropriation made by the Legislature at the regular sessions.

The act also prescribes a method of taking over all the turnpikes or toll roads; also prescribes a method of reconstructing roads, streets and highways in boroughs and incorporated towns. The act also permits the State Highway Commissioner to change the location of a route if, in his opinion, it is dangerous or inconvenient to the traveling public as at present located. Any such change in route must have the approval of the Governor.

The act provides that all highway improvement and construction or rebuilding under the provisions of this act shall be macadam, telford or other stone roads, or constructed of brick, gravel, cinders, oyster shells or other good materials, or combination of materials, in such manner that the same, of whatever materials constructed, will with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel. The selection of materials to be made by the State Highway Commissioner and the improved portion of the road constructed shall be of a width of not less than twelve feet.

The act also provides for a system of State aid roads similar to that provided for by the act of May 1, 1905. Applications for State aid work are to be filed as heretofore, the State, however, paying fifty per cent. of the cost of reconstructing these roads, the county and the township each paying one-fourth the cost thereof. Under the old law the State paid seventy-five per cent. of the cost of reconstruction. The act also provides that the State Highway Department, in the construction of State aid roads, can make a contract for the amount of money to be contributed by the State plus the amount of money to be paid by the county and township respectively. It also provides for the marking of the State highways and for the erection of suitable sign boards at main cross-roads. An appropriation of three million dollars is provided to be used to establish and carry on the work of the department and for the purpose of maintenance, repairing and construction of State highways therein described, and for the payment of the State's share of the maintenance and repair of State aid highways heretofore constructed or improved under the provisions of this act. The work of maintaining all State aid roads will be done by the State Highway Department and fifty per cent. of the cost thereof collected from the township or borough or incorporated town in which said State aid roads have been reconstructed The sum of one million dollars is appropriated by the act to carry out the provisions thereof in the reconstruction of State aid roads. This sum, when increased by the shares of the counties and townships, will give the sum of two million dollars for State aid work. About six hundred miles of road already reconstructed by the State Highway Department are included in the routes designated in the Sproul law as State highways.

The work of reorganizing the department on lines to put into effective operation the law will require time, but it is the intention

of the commissioner to carry on the work of maintenance, repair and construction of State highways as equally and uniformly in the several counties as conditions will allow, and at the same time do as much State aid work as the available funds will permit.

Rochester's Street Improvement Record.

All records for street improvements in the way of pavements, sewers and walks in Rochester, N. Y., were broken in the present year, according to the figures of the engineering department and the board of contract and supply. Thus far in 1911 contracts have been let for pavements costing $1,074,990 and for sewers costing $395,503.

A large proportion of the improvement contracts have been completed. It is not believed that any more important work will be authorized this year, as the cold weather is an effective barrier to everything except sewers. Contracts may be let with the proviso that work shall be begun as soon as practicable in the spring.

Recent Progress in the Good Roads Cause.

(Continued from the November issue of MUNICIPAL ENGINEERING.)

MISSISSIPPI.

There has been very little activity in road improvement in Mississippi. It is reported that only 0.86 per cent. of the roads in the state have been improved.

It is estimated that there are 44,004 miles of road in the state. In response to a recent request one-half the counties in the state reported, and nine of them reported 144 miles of gravel road, from one to thirty-one miles per county. Eighteen counties report from $15,000 to $200,000 of bonds issued to pay for good roads, amounting to $1,130,000, which is probably about half the total bond issues by counties. Twenty counties report the use of convicts on the roads, with varying success.

Hinds county reports a $200,000 bond issue by two districts for gravel roads, and twenty miles under contract. Four miles were built in 1911 at a cost of about $3,500. The working of the 800 miles of road in the county is let by contract for three years, and costs about $40 a mile.

The local roads are in charge of the county boards of supervision, elected one from each of five districts into which each county is divided. One overseer is appointed for each supervisor's district.

Mississippi has a population of 1,797,114, which is increasing about 15 per cent. per decade, and its 79 counties range in population from 6,000 to 64,000.

MISSOURI.

The Missouri highway law was passed in 1907, under which Curtis Hill, Columbia, is state highway engineer, under the state board of agriculture.

Prior to 1910 $475,000 had been spent in state aid of construction of roads. In 1910 $75,000 was spent and the appropriations for 1911 aggregate about $300,000. The state pays half the cost of state aid roads and the other half is paid by the county, the township or the abutting property.

Of the 107,923 miles of road in the state 4,756 have been improved. The cost of build-roads is reported to be 48 cents per square yard for macadam, 27 cents for gravel and $1.20 for bituminous surfaces. Individual macadam roads have cost from 33½ cents to 56 cents per square yard or $1,769 to $5,120 per mile. The route for a state road from St. Louis to Kansas City was recently selected.

The local roads are in charge of the county court of three judges and the county road engineer. Each county is divided into road districts of six school districts or more, and an overseer is elected for each district.

Missouri has a population of 3,293,335, which is increasing more than 5 per cent. per decade, and its 115 counties range in population from 6,000 to 284,000, not including the city of St. Louis.

MONTANA.

The information at hand regarding Montana roads is very meager. The local roads are in charge of boards of county commissioners of 3 members each, who divide their counties into suitable road districts and appoint a road supervisor for each. Automobile clubs are agitating for the granting of federal aid for road building in the state.

Montana has a population of 376,053, which is increasing nearly 55 per cent. per decade, and its 28 counties range in population from 3,000 to 57,000.

NEBRASKA.

But little has been done as yet toward state aid of road improvement in Nebraska, the only aid heretofore having been toward construction of bridges.

The local roads are in the hands of the boards of county commissioners of 3 members each and the county surveyor. In counties having township organization the township boards have direct charge of the roads in their township. In those having no township organization the counties are divided into road districts and an overseer is appointed for each district.

Nebraska has a population of 1,192,214, which is increasing over 11 per cent. per year, and its 92 counties range in population from 1,000 to 169,000.

NEVADA.

Plans for construction under the new state highway law were not matured until June, 1911. Since then 2 miles of first-class macadam road have been constructed and 3 miles have been graded ready for macadam on a road from Carson City to Reno. Later

a highway from Carson City to Lake Tahoe is planned to connect with the California state highway recently built. W. M. Kearney, Carson City, is state engineer.

The last legislature authorized the use of convict labor on the roads.

The appropriation for 1911 is reported to be $20,000.

Local roads are in the charge of boards of county commissioners of 3 members each, who divide the county into road districts and a road supervisor is elected for each.

Nevada has a population of 81,875, which is increasing neary 95 per cent. per decade, and its 15 counties range in population from 2,000 to 17,000.

NEW HAMPSHIRE.

The New Hampshire road law was originally adopted in 1903. The state roads are in charge of the highway department, with H. C. Hill, Concord, as state engineer. Towns are required to raise money for taxation for road purposes, from 25 cents to $1 per $1,000 assessed valuation being so raised. To secure state aid 50 per cent. additional to the sum so set apart far main highways must be raised. The aid then granted by the state varies from 20 cents to $3 for each dollar which is so raised by the local authorities. The total expended for state aid prior to 1911 was $706,605, and also $497,929 for trunk line roads. The appropriations for state aid in 1911 were $125,000 and for trunk line roads $250,000. Work in 1911 did not begin until September, so that nothing can be said of this year's work.

Of the 15,116 miles of road in the state 1,448 have been improved. State aid roads completed prior to 1911 measure 248.1 miles, and trunk lines constructed by the state measure 254.3 miles.

The average cost of roads constructed is reported to be 78 cents per square yard for macadam, 39 cents for gravel and $1.05 for bituminous surfaces.

Highways are maintained by the local authorities.

Of the 194.2 miles of road constructed with state aid in 1910, 57 miles were macadam, costing $6,539 per mile; 135.8 miles were gravel, costing $3,356 per mile; and 1.4 miles were bituminous macadam, costing $7,709 per mile. No state roads were constructed in 1910, the available funds being used in maintenance of roads already built.

In 1909 there were built 58.44 miles, of which 4.6 miles were trap-work macadam, costing $6,900 per mile; 6.04 miles were native stone macadam, costing $5,300 per mile; 46.5 miles were gravel, costing $3,450 per mile; and 1.3 miles were bituminous macadam, costing $7,800 per mile.

Local roads are in the charge of boards of county commissioners of 3 members each and of the selectmen in the towns. Three highway agents are elected in each town to have charge of the road work under the selectmen. Funds for local roads are raised at annual town meetings, and must equal at least one-fourth of 1 per cent. of the property valuation of the town.

New Hampshire has a population of 430,572, which is increasing nearly 5 per cent. per decade, and its 10 counties range in population from 16,000 to 126,000.

NEW JERSEY.

The original of the present New Jersey state aid good roads law was passed in 1891, but numerous amendments and additions have been made. The department of public roads, of which E. A. Stevens is commissioner and R. A. Meeker is supervisor, has a consulting and advisory character, rather than one of immediate direction. The subordinate force consists of two assistant supervisors, and estimator, a secretary and a clerk. Plans, profiles and specications are prepared by the county authorities and contracts are let by them, but, as nothing can be done without the approval of the state commissioner, it results that the state prepares standard specifications which receive only such modifications by the local authorities as local conditions require. Stone, gravel, bituminous macadam, asphalt concrete, and macadam with surface dressing of heavy asphalt oil are the classes at present standardized.

In 1892, the first year under the state aid law, 10.55 miles of road were constructed in one county. Since that date the yearly construction has varied from 27.34 miles to 154.74 miles per year, and the total, including 1910 and roads under construction to be completed in 1911, is 1,562.2 miles. The state's share of the cost of these roads has been $3,059,883. The total cost of these roads is three times this sum.

The law provides a process of petition for roads in a county, selection of the roads to be improved with the available funds of the year by the board of chosen freeholders of the county, with the approval of the state highway commissioner, when one-third the cost will be set aside by the state to aid in paying for the road, provided the total for all the counties of the state so set aside shall not exceed $400,000 a year. The local funds raised for road construction and repair cannot exceed one-fifth of 1 per cent. of the assessed valuation of the county. The state commissioner selects the supervisors in charge of the construction of the various roads, and they are paid from the state appropriation for the roads on which they are employed. Repairs must be made by the county under the county supervisor, and, if not made, the state commissioner may withhold any state funds due or coming due to the county until satisfactory repairs have been made. The county supervisors are appointed to oversee repairs and are removable by either the county board

or the state highway commissioner. The act applies to all organizations in the state except cities, and any of them can construct roads under its provisions. By other laws the owsership of two-thirds of the property along the road proposed to be improved may agree to pay 10 per cest. of the cost of a road when the cousty must construct it; a county engineer is provided for in addition to the county supervisor; for two assistant supervisors in the state commissioner's office, to supervise the expenditure of the funds from automobile licenses in the repair of roads; for an ocean boulevard from Atlantic Highlands to Cape May; for the Henry Hudson drive in the Palisades Interstate Park; for a scenic highway along the Delaware river; for joint construction and repair of roads through two or more counties and for paving roads.

Convict labor is used in some counties for crushing stone.

Of the 14,842 miles of road in the state, 3,378 have been improved, 1,562.2 with state aid.

The average cost of roads is reported to be 75 cents per square yard for macadam, 40 cents for gravel and $1.12 to $1.30 for bituminous surfaces. Telford roads cost 10 or 12 cents per square yard more than macadam.

The annual expenditures for repairs are indicated by the report for 1910, which shows $308,127 spent by the state from the motor vehicle fund and $1,086,169 from county funds. The receipts from the motor vehicle licenses amount to $382,000.

The proportions of various kinds of road are indicated by the construction in 1910 of 10,884 miles of macadam, 4,590 miles of telford, 17,759 miles of macadam with asphaltic binder, 1,809 miles of telford with asphaltic binder, 4,081 of oiled macadam, 15,848 miles of amiesite, and 25,403 miles of gravel, making a total of 80,374 miles.

There are hundreds of petitions on file for work in 1912.

The county roads are in charge of the county board of chosen freeholders, which has one member from each ward of first-class cities in the county, one more from each second-class city, two from each township of over 10,000 population and one from each smaller township, who appoint county supervisor and county engineer. Local supervision is also to some extent in the hands of township committees of three each, who appoint overseers.

The practical applications of the law to a county may be suggested by the following data for 1911 from Gloucester county:

Prior to 1911, 84.08 miles of road had been built by the county and with state aid, of which 46 miles were gravel, 19.48 miles were broken stone macadam, 14 miles were telford and 4.6 miles were bituminous macadam. During 1911 there were constructed 6.92 miles of bituminous roads, costing $83,122, or an average of $12,012 per mile. Of this mileage, 0.25 mile was of filbertine 30 feet wide and 7 inches thick, costing $4,300, or $17,200 per mile; 2.17 miles were of amiesite 16 feet wide and 7 inches thick, costing $26,400, or $12,166 per mile; 1 mile was of asphalt and stone, constructed by the penetration method, 16 feet wide and 8 inches deep, at a cost of $9,422; and 3.5 miles were constructed of Bermudez asphalt and stone, by the mixing method, 16 feet wide and 7 inches thick, at a cost of $43,000, or $12,286 per mile. The first road mentioned was paid for one-third by the state and two-thirds by the township; the second and fourth, one-third by the state, 56 2-3 per cent. by the county and 10 per cent. by the township; the third was paid for, $3,422 by the county and $6,000 from the state motor vehicle fund.

New Jersey has a population of 2,537,167, which is increasing nearly 35 per cent. a decade, and its 21 counties range in population from 21,000 to 537,000.

NEW MEXICO.

The original road law of New Mexico was passed in 1903, but the present good roads commission was created by the act of 1909. It is composed of the governor as chairman, the commissioner of public lands as secretary, and the territorial engineer, Charles D. Miller, Santa Fe, under whom the supervision of construction work is done.

The funds of the commission are derived from a tax of one mill on the dollar, the first of which was available for 1910.

There are about 16,920 miles of road in the territory, of which perhaps 400 are gravel and macadam. The expenditures of state funds in 1910 were nearly $67,000 upon roads, nearly 67 miles of which were completed. State aid has been used on 225 miles of completed road, and 175 miles additional have been repaired and partly reconstructed with state funds.

In progress in 1911 were 153 miles of new road; 28 miles had been surveyed and 250 miles inspected with reference to construction or repair in 1911 and 1912. The mileage of roads completed with local funds is reported to be 104. The counties have for road work the proceeds of local taxes of 3 to 9 mills per dollar, averaging some $3,000 per county per year.

Territorial convicts are worked on the roads.

The proceeds of the state road tax are about $50,000 a year. In 1910 and 1911 about $137,000 has been spent.

Local roads are in charge of boards of county commissioners of three members each, who divide their counties into three districts and appoint an overseer for each district.

New Mexico has a population of 327,301, which is increasing nearly 70 per cent. per decade, and its 26 counties range in population from 4,000 to 24,000.

STREET · LIGHTING

Sharon's Municipal Light Plant.—Municipal Ownership in Toronto.—The Development of Electric Lights.—Street Lighting in New Zealand.—Ornamental Street Lighting.—Ornamental Street Lighting in Vancouver.—Municipal Power Plant for Los Angeles.—Concrete Ornamental Posts.

Sharon, Pa., Contemplates a Municipal Light Plant.

The Sharon, Pa., council took the initial step in the matter of building a municipal electric light plant when the committee recently appointed to secure data from other towns which are operating their own plants, presented its report, showing the cost of erecting such a plant, cost of maintenance and expense of installing the necessary machinery and other equipment.

While no definite action has been taken, as yet, the council decided to investigate the proposition and to take the matter up for consideration.

A conservative estimate of the cost of installing the necessary machinery was as follows:

Power house, $7,000; two generators, 150 k. w., and exciters, $5,000; two 300-h. p. gas engines, $18,000; one six-panel switchboard, $1,000; arc rectifier equipment and lamps, $8,000; pole line equipment, which includes arc lamps, $10,000; consulting engineer, $1,000; total, $50,000.

By installing a plant of this type, two separate units, each sufficient to supply power for 350 four-ampere luminous arc lights, would be provided. The estimated cost of operating a plant is about $10,000 a year. At the present time the borough of Sharon is paying for the street lighting as follows:

149 arc lamps at $75 per year	$11,175
3 lamps at V bridge at $60 per year	120
50 gas lamps at $12 per year	600
1 man to tend gas lamps	480
Miscellaneous supplies	100
Total	$12,475

In the opinion of the committee it would be necessary to use about 300 arc lamps. To install this number of lights under the present system, even at a price of $65 per lamp, would mean an annual outlay of about $19,500, or very close to double the amount it would cost to operate a municipal plant.

The following is a list of towns lighted by contract and the amount paid per year by same:

Kittanning, Pa., 100 lamps	$30.50
DuBois, Pa., 150	45.00
Beaver, Pa., 100	65.00
Beaver Falls, Pa., 200	65.00
New Brighton, Pa., 200	65.00
Rochester, Pa., 125	65.00
Johnstown, Pa., 650	50.00
Oil City, Pa., 300	60.00
Portsmouth, Ohio, 400	48.00
Huntington, W. Va., 350	47.00

The following is an estimate of the cost of operating a plant for 10 years, including interest, depreciation, etc.:

Cost of plant	$ 50,000
Interest at 5 per cent	25,000
Cost of operating and repairs, including depreciation	100,000
Total	$175,000
Amount paid for street light at the present rate for 150 electric lights and 50 gas lights for 10 years	$125,000
Amount collected from individual consumers for 10 years, which is a very low estimate	50,000
Total	$175,000

If there were 300 lights installed and operated for 10 years at the above cost of $175,000, it would mean that the plant would be paid for in 10 years and the lights furnished at an annual cost of $51 each.

An investigation of the merits of the tungsten cluster system of lighting is being made and it is probable that such an installation will be considered. A power plant the size referred to in the report would successfully operate from 1,200 to 1,500 of these lamps.

Municipal Ownership in Toronto.

Toronto, Canada, possesses a municipal electric plant which is not only paying dividends but is furnishing current at a lower figure. On the first of January, 1908, Toronto decided to buy Niagara power from the hydro-electric commission and voted $2,750,000 to build and equip the plant needed to distribute it. An unsuccessful attempt was made to prevent the purchase by the privately owned plant who also purchased power, beginning in 1906, from a

Niagara Falls company. A reduction of rates from the private company had been sought and refused.

Since 1908 the municipal plant has forced a 40 per cent. reduction in rates from the private company and is supplying a surplus which will be used in wiping out a technical deficiency arising during the period of time that the initial consumption of power fell below the estimated quantity.

The rates charged by the municipal plant and the private corporation are given below:

Purpose	Av. City Rate per kw. hr.	Av. Co. Rate per kw. hr.
Residence lighting	4½c	8c
Commercial lighting, alternating current	4c	8c
Commercial power, alternating current	2c	4c
Commercial lighting, direct current (without storage batteries)	5c	8c
Commercial power, direct current (with storage batteries)	2¾c	4c

The Development of Electric Lights.

Maurice Solomon, A. C. G. I., M. I. E. E., has a paper in a recent issue of the English publication , Science Progress, which deals with the progress of the electric light. He mentions the fact that only five years ago the carbon filament lamp, which was invented in 1878, was the only one of the incandescent type of lamps. This carbon lamp had a life of only about 1,000 hours and consumes about 4 or 5 watts per candle power.

In 1898 the Nernst lamp was invented. Its filament is made of a mixture of oxides which become conducting at a moderately high temperature. To heat the filament up to the requisite temperature a porcelain spiral is wound openly round it, and a fine platinum wire is closely wound round the porcelain. The current flows through the platinum wire and thus heats the filament of the lamp. As soon as the filament becomes hot enough the current begins to flow through it and works a cut out which breaks the platinum wire circuit. Another complication is that as the Nernst filament falls in resistance its temperature rises, and it has to be run in series with a special resistance. Thus although the Nernst lamp was far more economical than the carbon filament lamp, it was so complicated that it was never used extensively.

In 1905 the first metallic filament lamp appeared, the Osmium lamp. But it was not a great success chiefly because the filament is so brittle when cold.

The Osmium lamp was quickly followed by the tantalum lamp, brought out by Messrs. Siemens and Halshire. For the tantalum lamp the average consumption in watts per candle is 1.85 for direct current lamps and two watts for alternating lamps; that is, it consumes about half the energy of the carbon filament lamp.

The next advance came almost immediately. The tungsten lamp, called the Osram lamp, was brought out by the Welsbach Company. It consumes between 1.2 and 1.4 watts per candle, during a life of at least 1,500 hours. The economy of this lamp and its durability has led to its adoption in street lighting.

The arc lamp, used for outdoor lighting and for very large interiors has also been much improved. This lamp consists of an arc burning between two carbon rods. In the open arc it is enclosed in a glass globe to protect it from the wind, etc.; and in the closed arc it is enclosed in a fairly air-tight globe, carbonic acid is given off and fills the globe and the carbons burn more slowly. Thus, although the closed arc consumes more energy than the open arc (2.3 watts per candle against 1.4 to 1.1 watts per candle), the carbons last longer and the arc does not take so much trimming.

The first noteworthy improvement consisted in the invention of hollow carbons filled with some volatile substance which, vaporizing, lowered the resistance of the arc and steadied it.

The first satisfactory flame arc was made by Bremen, 1898-1900; improvements were made subsequently and now the flame carbon has a core from one-third to one-half the diameter of the carbon. This core consists of carbon, potassium silicate, and a fluoride; calcium fluoride gives a yellow flame and strontium fluoride a red one. The fluoride volatilizes and lowers the resistance of the arc, and thus makes it possible to work with a longer one, a great advantage in many ways.

The yellow flame arc consumes four and the white flame arc seven watts per candle. The flame arc is thus much more economical than the open or closed arcs, which consume 1.1 to 1.4 and 2.3 watts per candle respectively.

When comparing the cost of the arc lamp with the metallic filament lamp it is necessary to take into account the cost of the carbons and of maintenance for the arc lamp. The cost of maintenance varies considerably according to the location of the lamp, and in some cases, although consuming more energy, the tungsten lamp, which can now be made in large candle powers, can compare successfully with the flame arc. This is particularly true in street lighting, and is evidenced by the rapid increase of ornamental incandescent systems.

Street Lighting in New Zealand.

The development of important water-power enterprises in New Zealand deserves the attention of American manufacturers of hydraulic and electrical machinery, who, in case they desire to secure a share of the orders for supplies, equipment, etc., should get

into communication with Mr. Evan Parry, the newly appointed electrical engineer for public works. There should be an advantage to American manufacturers in the fact that these enterprises are to be carried out by the Government, for when the Government imports material, it pays no duty to itself; whereas, in the case of imports by private concerns the question of duty, and more especiall preferential duty in favor of British manufacturers, would have to be considered.

The demand for electricity in New Zealand for industrial purposes, such as for factories, mining, tramways, street lighting, and for domestic lighting, heating, and cooking is increasing constantly. The public has become so educated to electricity that the need for its cheap development by water power is well recognized by Government authorities, who now feel that, unless they are prepared to permit private capital to establish water-power works, they can no longer refrain from committing themselves to the necessary expenditures and risks.

Electric street lighting is already fairly well developed in Wellington and Dunedin, 562,000 units being used last year in Wellington and 102,000 units in Dunedin. In Auckland one road has been successfully lighted with flame arc lamps, and no doubt the system will be extended to all the main thoroughfares. In Christchurch, street lighting by electricity has not yet been attempted, except for a few arc lamps maintained at the tramway stopping places. The minister of public works estimates that within the next five years owing to the introduction of cheap electric power, Wellington will have 190 miles of streets lighted with 220 electric arcs and 2,000 electric glow lamps; Auckland, 150 miles lighted with 200 electric arcs and 500 electric glow lamps; Christchurch, 170 miles lighted with 220 electric arcs and 400 electric glow lamps; and Dunedin, 180 miles lighted with 240 electric arcs and 600 electric glow lamps.

Ornamental Street Lighting.

Municipal pride and the desire to equal the achievements of neighboring cities has been responsible to a very great degree for the remarkable growth of the cause of better street lighting. Commercial clubs, civic organizations, and societies which have had the best interests of their cities in mind, have aided in securing even for the smaller cities, street lighting systems which, in addition to rendering their streets more beautiful, have a definte advertising value. Unlike most municipal improvements, ornamental street lighting has been developed simultaneously in the smaller and the larger cities. The application of the flaming arc, the Mazda, and tungsten lamps has revolutionized street lighting. These types have made possible lighting systems which are ornamental by day as well as by night.

The following is a brief account of some of the recent ornamental lighting installations:

Memphis, Tenn., is considering the question of replacing their unsightly wooden pole supported arc lights by the cluster system. Commissioner Dies has recently caused a number of ornamental steel poles supporting five light clusters, to be placed on various streets in order that the public may become acquainted with their superiority. The cost of the type of pole considered including installation is about $90. Commissioner Dies is seeking the co-operation of the property owners on the downtown streets with a view to immediate bettering of lighting conditions. This proposal was that if the property owners would agree to pay for the poles and cost of installation on the front foot basis, the city would keep the poles painted and supply current for their use.

Virginia, Minn., a city of 13,000 population has completed the installation of a tungsten cluster system, which was put in service on September 1st. The poles are of the five light pattern with 100-watt tungsten lamp, and are spaced eighty feet apart.

Pueblo, Colo., has installed a flaming arc system. The poles are placed 150 feet apart along each curb, giving a fairly uniform lighting along the entire street. The merchants contributed towards the installation.

Nashwauk, Minn., a town of only about 700 population has installed 22 iron lamp standards of the three light pattern. The central lamp is of the 60-watt size and the other two 40-watt. The central light is left burning throughout the night, while the other two are extinguished at 12 o'clock. The standards are placed 95 feet apart on both sides of the street.

St. Louis, Mo., has for some time been agitating the question of better street lighting. The street improvement association has, after a year's investigation of various street lighting units, recommended the use of the magnetite lamp. Broadway in St. Louis, with its three light standards supporting high power magnetite lamps, is an example of the type which they recommend.

Toledo, O., has its entire business section lighted by the magnetite lamps supported on two light ornamental standards. There are about 2,500 of these luminous are lamps in the business district.

St. Paul, Minn., has a five light ornamental lighting system in the downtown district which is enhanced on special occasions by the use of ornamental festoons, and by the decoration of the five light standards. A feature of the St. Paul instalaltion is the fact that the lamps are spaced uniformly, four on each side of the street to each block.

In Bloomington, Ill., a committee composed of Messrs. Frank Supple, John A. Beck, Frank Oberkoetter and C. C. Martens, who for some time have been engaged in the work of securing the subscription for the South

Main street cluster lights, announces that the list is now practically complete and the required amount of funds have been subcribed. According to the plans a total of twenty-eight lights wil be installed at a cost of approximately $2,600.

Ogden, Utah, has installed a cluster lighting system which is unique in several particulars. The posts are of the five lamp type, with four pendant, 60-watt and one erect 100-watt lamp. The posts are higher than it ih customary to use and are spaced 132 feet apart.

Pittsburg, Pa., has recently installed on Liberty avenue, a number of the larger size magnetite lamps. The arrangement is such that the lamps which are suported on either side of the street on 28-foot poles are spaced a distance of only 90 feet apart. The result secured is a powerful illumination over the entire surface of the street.

Council Bluff, Ia., has recently completed the installation of 5,000 candle power flaming arcs on Broadway. The effect secured is such that a shadow is cast in the brightest illuminated store windows by the light of the street lamps.

Chicago, Ill., is contemplating extensive lighting improvements throughout the city. A study of a practical light for Michigan boulevard has extended over a number of years. The South Park Commissioners have finally decided upon the use of the tungsten cluster lighting syhtem, and a very attractive standard supporting six pendant globes has been chosen. The lighting contemplated for other parts of the city is not to be of this type. The following statement from Wm. Carroll, city electrician, which appeared in answer to a question in a Chicago paper, will serve to give an idea of the policy which will govern lighting extensions in Chicago:

The plan for the instalaltion of the 10,000 additional lights to be placed in service by the sanitary district for the city has been taken up with each alderman of each ward. The electrical engineer of the sanitary district and the city electrician, who are responsible for these plans, recognize the fact that underground wires are better and safer than overhead wires, but the additional cost of the street work for street lighting service makes underground wires practically prohibitive at the present time.

The plans for this street lighting extension contemplate using conduits for the trunk lines and overhead work for distribution, using 5-inch, 25-foot, steel poles and from one to two No. 6 weatherproof wires. This type of construction is not unsightly and is not much more dangerous than when the wires are placed underground. Over two years ago this department lighted the streets bounded by Calumet avenue, State street, Thirty-ninth street, and, Garfield boulevard in this way. There have been no complaints made by the citizens in this district of the unsightliness of the poles or overhead wires, and there have been no accidents in said district since the lights were installed.

It is not the intention of the city to force the overhead wires and poles on any neighborhood where the residents and property owners consider them objectionable. It is the intention, for the time being at least, to leave out streets or neighborhoods where the property owners strongly object to the overhead wires, and proceed with the lighting plans where they want the lights badly enough to be willing to accept the overhead wires. The city will place the circuits underground on any street or system of streets where the citizens or property owners on such streets are willing to pay the difference between the cost of the underground construction and the overhead construction.

The city's plan for the installation of these lights does not contemplate large wooden poles and a number of wires, such as the average citizen has in mind when he hears of overhead construction.

As to the statement that it is unwise to install arc lights when other progressive cities are taking out their arc lights, we believe that the lights which it is proposed to install are the latest thing in street lighing, and that arc lighting is the only practical street illumination. Many citizens appear to believe that under the contract with the sanitary district they are to get such street lights as the South Park Commissioners have installed on Michigan avenue between Randolph and Twelfth streets, or such as the Lincoln Park Commissioners have installed on Lincoln Park boulevard. It would cost the city to maintain this kind of street lighting throughout the city from $40,000,000 to $60,000,000 a year, this estimate being based on the cost of maintaining the south park lights per mile of street and the Lincoln Park boulevard lights per mile of street multiplied by the number of miles of streets in the city of Chicago.

The cost for maintaining the city's street lights during the year 1910 was as follows:

Gas lamps	$ 303,843
Gasoline lamps	188,546
Rented electric lights	67,395
Municipal electric lights	466,714
Gas office	16,903
Total cost for 1910	$1,043,401

The total appropriation for corporate purposes fund, not inc'uding amounts contingent upon bond issue for the year 1911, was $24,-093,532, so that there can be no possible chance of the city's installing and maintaining street lights that will cost as much per mile of street as the Michigan avenue lights, the Lincoln Park boulevard lights, or the lights installed by commercial companies, at the expense of the property owners along business streets where special lighting is required.

Ornamental Street Lighting in Vancouver.

Vancouver, B. C., is using tungsten clusters. The lighting units on each street standard are shaded by sand-blasted instead of ground-glass globes. Each of the tandards is placed from 89 to 134 feet apart on both sides of the street and equipped with five 75-candle-power lamps. The top lamp is lighted throughout the whole night, while the other four are turned off at midnight. The standards are 14.5 feet from sidewalk to center globe and 10.5 feet to the lower globe. The diameter at the foot of the column is 7.25 inches, tapering to 5 inches. The distance between the two lower globes is 3 feet 3 inches. The base of the column is 1 foot 8 inches square.

The city council is arranging to provide for the maintenance of the lamps and the supply of the electrical energy, while the property owners will pay the first cost of the installation. The equipment as a whole

will cost the property owners from $2.10 to $2.65 per front foot, varying according to distance between posts.

The conduits are of steel and covered with a 2-inch plank, or of 2-inch hydraulic pressed fiber ducts laid in a 3-inch bed of concrete. All service and main conduit wires are on the three-wire system, lead encased cable with sheathing not less than 3-32 of an inch in thickness.

The concrete bases for the standards are 21 inches deep by 24 inches square, with 0.75-inch bolts, 24 inches long, embedded, to which the standards are firmly fastened.

Each standard is equipped with five 75-watt tungsten lamps, one 16-inch and four 12-inch spherically shaped globes, and in the base of each standard a transformer to reduce the voltage.

Municipal Power Plant Recommended for Los Angeles.

E. F. Scattergood, chief electrical engineer of the power bureau of the aqueduct, returned to Los Angeles recently after seven weeks spent in other places studying the more important hydro-electric power systems and the electric current distributing systems of the country. The report of Mr. Scattergood is briefly as follows:

The inspections of the more important hydro-electric power systems and distributing sytems of this country were made by Consulting Engineer Harris J. Ryan, Assistant Engineer T. A. Panter and myself with the result that we have secured much valuable data and information as to the good and bad qualities of the various types of machinery and equipment and methods of operation based on the experience of those in charge of these systems.

We saw a number of generating systems and I feel confident that the Los Angeles aqueduct power system will deliver power at a considerable lower generating cost than that for which it can be delivered to any other city in the United States excepting those in the vincinity of Niagara Falls.

Securng a low generating cost is, however, but a part of the fight to secure cheap rates to light and power consumers, which is the end to be sought and the only real basis for comparison.

Pasadena's municipal plant has a higher generating cost than that of the companies supplying Los Angeles, but can offer consumers lower rates than can be secured for the consumers of Los Angeles under present conditions. The generating cost at Niagara is still much lower, and yet the rates to consumers in the surrounding cities and towns are even higher than in Los Angeles at the present time.

With a complete municipal distributing system and an amount of business equal to that within the city for the year 1910, there could be established a 6-cent rate with a proportional scale for all classes of consumers, and, at the same time, experience a net profit, including interest on the investment and an allowance for depreciation and bond payments, of $700,000 annually. With the total business for the year 1913, excluding railway power, this annual net profit would be far in excess of $1,000,000 with the same 6-cent base, or the rate to consumers could be made proportionately less.

In that statement I have tried to strike a mean, giving both a reduced rate to the consumer and a large profit to the city for the benefit of the man who pays the taxes.

Concrete Ornamental Posts in California.

A new venture in municipal lighting is being made by Venice, Cal., with a concrete ornamental post, designed by City Engineer Lewis. Te city will manufacture them to sell to property owners at cost and furnish light free of direct charge. Molds made to order have been procured by the city and all preparations for producing the standards in municipal yards are complete. The post itself will cost $9. The total expense of setting up the concrete post, equipping it with electric light and connecting with conduit is placed at $15 each.

Such an innovation in ornamental lighting systems was first proposed by City Trustee Lorenz, formerly in the service of the Southern California Edison Company. A sample post, complete for service, is being exhibited.

Profit Sharing in Municipal Gas Plant.

For a period of five years the Stafford, England, municipal gas department has had in operation a system of profit sharing that appears to have proved satisfactory.

When the total cost of manufacture and distribution of gas is less than 20 cents per 1,000 cubic feet of gas sold, a bonus equal to one-fourth of the difference between that sum and the actual cost shall be divided among the workmen and clerks who have been employed in the department for not less than three months during the year in which the bonus has been earned. In any year where special charges, such as for mainlaying operations, have been charged against revenues, the amount of same is to be deducted from the true manufacturing and distributing charges, in addition to the net cost of coal, rates and taxes, depreciation, and depreciation on cookers, etc., and consideration is also to be given to the profit and loss on gas fittings.

The following are the bonuses paid to the men during the past five years: 1906-7, 7½ per cent. on total wages paid; 1907-8, 9 per cent. on total wages paid; 1908-9, 9¼ per cent. on total wages paid; 1909-10, 9½ per cent on total wages paid; 1910-11, 10½ per cent. on total wages paid.

CURRENT · INFORMATION

Refuse Disposal in Berlin.—New York's Municipal Training School. — Motor Bus Transportation.— Engineering Exhibit at Baku.—Report on Paving Repairs in Chicago.—Los Angeles Refuse Disposal.—Street Signs in London.

Refuse Disposal in Berlin, Germany.

In a recent report of Consul General A. M. Thackara from Berlin, Germany, a short account of the garbage and refuse disposal system of that city is given. An abstract of this report is here noted.

The city administration supervises the cleaning of the streets, but the disposal of the sweepings and refuse gathered is left to various contractors. Some of these concerns have purchased barren and unproductive land to be used as dumping grounds, and as the refuse contains principally sand and horse manure, it is exceedingly valuable as a fertilizer and filler for such lands.

By law and by municipal police regulations, house owners are obliged to provide for the removal of the waste from their buildings. For this purpose they have formed an association that includes most of the owners in Berlin. This association has made a contract for 30 years, 21 of which are still to run, with a limited liability company, which was formed for the express purpose of disposing of household and other waste. They have erected a building for the purpose of handling the garbage, disinfecting it, and separating the different articles, such as metal, rags, and bones. All the refuse is then disposed of for fattening hogs, fertilizing, paper making, or for grading purposes, etc.

Ingeniously contrived wagons are used in collecting the garbage. In every building large sheet-iron tanks or buckets are placed. The daily refuse is thrown into these tanks, which are capable of holding 100 or 200 pounds of ashes and garbage, and which close with a lid. The ashes and garbage are placed in separate receptacles. On certain mornings of the week the tanks are collected by wagons accompanied by three or four men. These wagons are large and tightly covered. A chain elevator is arranged so that a bucket can be placed upon a shelf on the side of the wagon and then raised and dumped into the wagon without permitting any of the dust to escape.

Ash barrels or other such receptacles are not permitted on the streets in Berlin. The experiment of burning the organic waste of Berlin was tried, but it proved costly and unsuccessful and was given up.

New York's Municipal Training School.

A contribution of $80,000 from Mrs. E. H. Harriman, supplemented by some thirty smaller individual subscriptions by public-spirited citizens, among them John D. Rockefeller, Andrew Carnegie, Henry Phipps and J. P. Morgan, has made possible the establishment in New York of an experimental school for the study and administration of civic business in connection with the Bureau of Municipal Research of that city. It is announced that its scope is intended to be national.

The curriculum will embrace the analyzing of budget estimates and all public expenditures, the drafting of city charters, the study of health problems, the standardization of salaries, contracts and specifications, model municipal accounting, methods of assessing and collecting taxes, and the preparing of official statements for publication. The New York Bureau of Municipal Research is constantly receiving applications from similar organizations in other cities for qualified men to perform the same kind of work that is being done in the metropolis, but it has found it impossible to supply the demand. It is proposed that graduates of this new school shall fill these positions.

The line of training proposed in the New York school will include education for college graduates who may desire to go into the public service, accountants wishing to qualify for public business, superintendents for schools, secretaries for boards of trade or heads of civic organizations, and will offer advantages for post graduate students of politics, economics, sociology, law and other practical work that will fit them for public duties. The time is sure to come when all municipalities will look to the fitness of those who are selected for service the same as is done by corporations, and when that is done the best interests of the people will be conserved

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Motor Bus Transportation.

A new field for the motor truck and a convenient means of transportation is being developed, by the application of motor vehicles to passenger transportation. The private motor car for business and pleasure purposes,

and the bus lines maintained by the large city stores for the convenience of their patrons has been followed by the practical use of the motor bus as a passenger carrier, traveling on a schedule over a prescribed route.

The first example of this use of the motor vehicle was in New Haven, Conn., where a bus line was established on Orange and Grove streets. The character of Orange street, a principal residence thoroughfare, led to opposition to the attempts of the electric railway company in obtaining a franchise along the street. A horse-drawn bus line had been in operation for some years, when in 1909, S. A. Lewis conceived the idea of operating a motor bus line. Four buses were obtained and the line was put in operation, giving such satisfaction that two more cars have been added.

The following report of this bus line for the year 1910 indicates that it has proven remunerative:

Interest on original investment at 6 per cent	$ 930.00
Rent, light and heat	450.00
Wages	7,500.00
Depreciation at 15 per cent	2,325.00
Gasoline	1,980.00
Oil and Grease	128.00
Tires	466.66
Repairs	637.96
Total	$14,417.62
No. of buses	4
No. of round trips	40,800
No. of bus hours	19,200
No. of bus miles	163,200
No. of passengers carried	540,263
Total amount of 5-cent fares	$27,013.15

Leaving for total year's profit...$12,595.53 (which is 81.2 per cent on the investment.)

In the above figures, everything has been cared for except management and office expense. Up to the present, Mr. Lewis has looked after details in person, but with the increased equipment, the salaries of one or more assistants and office expense will have to be added.

The cars are the regular model R-14, manufactured by the Knox Automobile Co., Springfield, Mass., which is a two-ton carrier, with 40 horsepower four-cylinder engine. The wheelbase is 125 inches and maximum speed, 15 miles an hour. The body space is 10 feet long by 5 feet wide, but on later vehicles, it will be noted from the picture that the body is made longer and overhangs at the back. The front construction is such that the driver both operates the vehicle and controls the in-and-out movement of the passengers, thus dispensing with the necessity for a conductor.

With the exception of a short time when by reason of faulty street cleaning, the accumulated snow and ice prevented their operation, the cars have been run on a regular 10-minute schedule throughout the year. The class of traffic carried is practically the same as any street car operating through the residential section.

There has recently been installed in Meridian street in Indianapolis, Ind., a bus line which is similar in many respects to that operating on Orange street in New Haven. Meridian street is one of the most aristocratic residence streets of the city; in fact, the "Fifth Avenue" or "Michigan Boulevard" of Indianapolis. It is paved for practically its entire length with an eighty-foot roadway of wood blocks. The character of the street and the class of residences along it have made the construction of a Meridian Street car line undesirable.

These features coupled with the fact that one of the nearest electric car lines extends only to Twenty-second street, while Meridian street is thickly built up past Thirty-fourth street; and the other operates so as to be crowded at all hours of the day, led to the idea of the motor bus line.

A company was organized, of which James T. Eaglesfield is president; and seven motor buses were purchased from the White Company, of Cleveland, O. A garage, perhaps more properly a car barn, was constructed, having space and repair facilities for eight or ten cars, with ample and safe provision for the storage of oil and gasoline.

The cars are of special body construction, though the truck is the ordinary 1½-ton commercial truck, manufactured by the White Company. The engine is of four cylinders. 30 horsepower, water cooled; and is connected to the shaft drive through a leather

THE KNOX MOTOR BUS IN NEW HAVEN.

faced cone clutch, a four-speed transmission being provided. An extra long, 144-inch, wheel base provides against the excessive jar or vibration common to a short wheel base. Special spring construction, and the so-called "Sewell" cushion wheel are other features which cooperate to lessen the vibration. The "Sewell" wheel is a feature worthy of note. It consists essentially of an outer hard rubber tire set upon, and separated from an inner hard rubber rim by a series of ⅜-inch rubber cylinders which are placed transversely to the two tires, or better, the tire and the rubber rim. An outer and inner rubber flange hold the cylinders in place; and the result obtained is a great improvement over the hard rubber steel-rimmed tires.

The body construction, with the two long

seats along either side, allows seating capacity for 18 persons, and in case of necessity standing room may be had for 10, giving a total capacity for 28 persons. The driver, who is also the conductor, is seated near the forward entrance, where a "pay-as-you-enter" fare register is provided. A rear door and automatically operated drop step are provided for egress only. The cars are heated by a system of coils through which the hot waste gases from the motor are conducted; while the current for the electric head and tail lamps is provided from storage batteries.

The cars have been operated for about one month, and have proven very satisfactory in that time. With six years in operation and one held in reserve, 23 round trips are made per car each day, operating on a 7-minute schedule. The route is about 3.4 miles in length and extends from the Monument Circle to Thirty-fourth street. Stops are made on the "near side" to take on and discharge passengers, and as the line operates only to the edge of the downtown district, little trouble is experienced due to traffic congestion.

Since the start a steady growth has been noted in the number of passengers carried. This has been particularly true of the class of traffic carried to and from theaters and

THE WHITE MOTOR BUS IN INDIANAPOLIS.

to the downtown district for shopping purposes. No figures of cost are available at this time and the only statement obtainable regarding the volume of business, shows an average daily traffic of about 1,400 passengers. The fare charged is 10 cents for a single ride, 10 tickets for 50 cents and 21 tickets for one dollar.

So far as is known the two examples noted are the only motor bus lines operated in the United States as commercial pessenger carriers. Chicago has at present a number of gasoline motor buses running between the great department stores on State street and one of the railroad depots. Other concerns also have approached the Chicago Motor Transfer Company with a view to obtaining motor bus service from their establishments to the downtown shopping districts and various other strategetic points. Among these are the Chicago Athletic Association, the University of Chicago, the Blackstone hotel, and the Aurora, Elgin & Chicago railway. The lines operated in New Haven and in Indianapolis differ in the fact that they are on a purely commercial basis, similar in most features to the electric street railway line.

Engineering Exhibition at Baku.

The Baku branch of the Imperial Russian Technical Society has perfected plans for holding an international engineering exhibition at Baku, Russia, next April, which will be under the special patronage of the viceroy of the Caucasus.

Among the chief exhibits will be electrical motors, internal-combustion engines, air compressors and other equipment for oil-field development, while a special section will be devoted to motor cars, which, both for purpose of pleasure and business, are finding great favor in southern Russia. With a view to inducing English manufacturers to participate in the exhibition, reduced railway charges from Batum to Baku have been arranged for the exhibits, while after the close they will be returned free of all freight to Batum, from which port there are regular sailings to England. Another important concession to English exhibitors is that no duty has to be paid upon the exhibition goods entering Russia. The exhibition will remain open for six weeks. Dr. P. Dvorkovitz has been appointed the official honorary representative of the exhibition in England, and he will give full particulars to all inquirers at 1 Broadstreet Place, E. C., London.

Repairing Asphalt Pavement in Chicago.

The Bureau of Public Efficiency of Chicago has recently issued a report covering the asphalt pavement repairing done under the 1911 contract. Bids were requested on May 6, 1911, for repairing aproximately 100,000 sq. yds. of asphalt pavement. The specifications fixed a price of $7 per cubic yard for concrete and $5 per ton for binder, and a minimum charge of $10 for the repair of any opening was made. Four companies bid on the work, and the contract was awarded to the American Asphalt Paving Company at 59 cents per sq. yd.

Some dissatisfaction is expressed in the bureau report, both as to the scope of the repair work and as to the method followed in doing the work. Specific instances of faulty construction are cited in the criticism offered. The following are some of the defects noted:

Specific instances were noted by bureau investigators in which the cutting out of the

pavement extended from 6 in. to 2 ft. beyond the lines laid down by the inspector for the city. Other instances are given, in which the contractor removed portions of this pavement between patches, with no obvious reason.

In removing defective pavement it was the custom to lift it with picks or bars and break it off with the cutter. This caused the pavement in many places to be lifted beyond the line marked by the inspector, and destroyed the bond between the binder and the concrete base.

The specifications required that the binder be brought upon the street at a temperature of from 200 degrees F. to 225 degrees F. Instances were noted where the binder as delivered on the street it could be picked up and handled with the bare hands. On June 13 a load of binder was used on North Clark street, which arrived on the work too cold to shovel from the wagon, and the rake and shovel were used in pulling it out from below the wagon.

The thickness of the top coat of repairs was measured at 370 places on the West Side. The thickness specified was 1½ in. Twelve measurements were more than 1½ in.; twenty-seven measurements gave a thickness of 1½ in., as required under the contract; 331 measurements were less than 1½ in. and averaged 1 1/64 in.; 167, or a little over 50 per cent., were of 1 in. or less. Correspondingly irregular measurements were shown on the North and South Side work.

Specifications required that the wearing surface should be dumped at such distance from the work that all of the mixture should be turned and distributed to the place where it was to be raked. Inspection by bureau investigators showed that the wearing surface was shoveled from the wagon to a point as near as possible to where it was to be used.

The reason assigned for these irregularities is given by the bureau as lack of effective inspection. It was noted that in most all cases there were enough local and general inspectors on the street to give adequate supervision and inspection to the construction in progress. That the inspection was, however, inefficient was evidenced by the great number of instances of non-compliance with the specifications which were noted during the investigation.

In view of the situation discussed above, the bureau submits the following recommendations and conclusions in respect to specifications for asphalt repair work and in regard to the inspection of the work done under the contract.

I. Specifications—

1. Specifications for asphalt repairs should be so changed as to provide either for one competitive bid on binder per ton, concrete per cu. yd. and surface mixture per ton.

2. The city should fix in the contract a lower rate than $5 per ton for binder and $7 per cu. yd. for the concrete.

3. The contract should be so changed as to give to citizens the same rate for repairs as is given the city.

II. Enforcement of Contract Provisions—

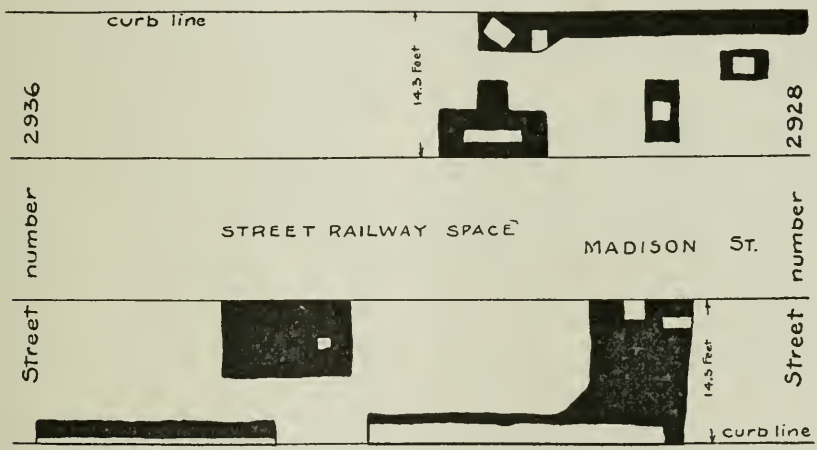
Work done under the specifications is defective in the following particulars:

1. Larger areas of pavement are removed than is necessary.

2. The pavement is damaged by careless methods of cutting out the defective pavement.

3. Often the binder lacks the stone specified in the contract, is laid cold and is not promptly covered with wearing surface.

4. The thickness of the wearing surface is in many instances below the 1½-in. requirement of the contract.



MADISON STREET REPAIRS. WHITE SPACES SHOW PORTION REPAIRED; BLACK, THAT WHICH SHOULD HAVE BEEN REPLACED.

5. The method of mixing, raking and rolling the wearing surface is frequently inadequate to the specified requirements of the contract.

III. Records—

In order to test the life of the original pavement and repairs a complete street map showing the exact location and time of repairs should be kept. These records, properly kept and analyzied would be valuable in determining at what time the repairs should cease and when the roadway should be resurfaced.

IV. Municipal Asphalt Paving Repair Plant.

In view of the difficulty experienced in securing full value for the wheel tax fund expended in street repairs, the bureau suggests that the city consider seriously whether the work of asphalt paving repair might not be more economically performed by the city itself.

The accompanying figure gives a comparison of the amount of repair work which has been done and that which is estimated by the Bureau of Public Efficiency engineers to be necessary.

Los Angeles' Refuse Disposal.

Los Angeles' garbage at the present time amounts to about 175 tons daily. This is collected from cans set out on the edge of the curb and is transported by the V. D. Reduction company and fed to 12,000 hogs. The hogs thrive upon the food, and when they attain a marketable size are brought to the city and sold.

The city's garbage is a constantly growing quantity. At the present time it is enough to feed between 15,000 and 20,000 hogs.

The city pays $4,000 a month to have the garbage removed and seems satisfied with the agreement; the contractors who feed the garbage they collect are pleased with the plan, for they are making money from the pork. But aside from the mere financial bargain, the city officials and the public have shown their dissatisfaction with the present plan and other methods of disposing of the garbage can's contents are being seriously discussed.

Most cities have disposed of the garbage question by the erection of a reduction plant, or incinerator, although coast and river cities find dumping in the stream a satisfactory and cheap method. New Haven, Conn., has tried the hog-feeding system, but found itself with a bill of $40,000 on its hands for "care of the pigs" after three months.

Collections are made from hotels daily. From the lodging house district they are made three times a week, while the residence district has to be content with two collections weekly. For this work, the V. D. Reduction company is paid $48,000 a year. There is under consideration now a plan of having hotel collections made from the premises instead of from adjacent pavements, the apartment houses given six calls weekly, and residence sections three instead of two. According to figures submitted, the additional cost would be $33,500 a year.

It is probable that the growing dissatisfaction with the present method of disposal will lead to the adoption of other measures.

Street Signs in London.

A recent issue of the Surveying and Housing World states that the Royal Institute of British Architects is calling attention to the importance, both in an aesthetoc sense and as a matter of public convenience, of steps being taken by the Borough Councils of London towards the provision of name tablets for the corners of streets with well-designed letters preferably of a uniform style throughout the metropolis. Whilst in Paris every street corner bears the name of a street, in London there are hundreds of corners where no names are to be found, so that it is often difficult to discover the name of a street without inquiring or walking some distance along it.

In regard to the aesthetic question, the Institute suggested that a good type of lettering should be adopted on two scales, the larger or maller scale to be adopted according to the width and importance of the street and the architectural scale of the buildings flanking it. The Institute also expresses the opinion that one of the faults of the present condition of affairs is that not only are name tablets wanting in many situations, but that those which exist are in so many different forms and patterns, and, in stating that they do not advocate the employment of any tablet more costly than those now in use, they suggest that if the Borough Councils are willing to consult together on the subject and to take up the matter and agree upon a pattern of lettering, uniformity for the whole of London could be secured to the great advantage of the appearance of the streets and general convenience of the public.

Cincinnati's Municipal Laundry.

Cincinnati has recently opened a municipal domestic laundry where poor women of the tenement districts may take the family clothing and do their own washing with the aid of the most up-to-date machinery. The equipment of this laundry includes enough power washers, driers and electric irons, to accommodate 500 family washings each week, and the city is preparing to build more laundries of like nature. The idea originated with the board of health, which was quick to recognize the sanitary advantages derived from removing clothes-washing operations from the living and sleeping rooms of the tenement dwellers.

MUNICIPAL AND TECHNICAL LITERATURE.

Books for Engineers.

Books for Engineers.

Good Engineering Literature: What to read and how to write with suggestive information on allied topics. By Harwood Frost, M. Am. Soc. M. E., M. Soc. Prom. Eng. Educ., etc. Cloth, 420 pp., $1 net. Published by the author. Chicago Book Co. agents, 226 S. LaSalle St., Chicago, Ill.

The above title is correct with one exception, viz.: that the book devotes very little space to what to read, but is given up almost exclusively to instructions on how to write and how to make a book. In this field it is unique, and takes the same place that several hand books published by large publishing houses do in the general literary field.

The earlier chapters are on literary expression and the need to the engineers of correctness and facility therein, rhetoric and grammar, orthography and punctuation. words and phrases. In the latter chapter the ambiguity and the inaccuracy in the use of numerous engineering phrases is clearly shown, as well as the necessity for greater precision.

Inspiration and motive in literary work, essentials to success in literature, what to write about, collecting and arranging material, are general subjects which the author treats with special reference to the preparation of engineering literature with much good advice. Exercising the memory is a subject interjected which receives very unsatisfactory treatment.

The preparation of manuscripts for publication, mainly the manual labor of the process, which he terms editing the manuscript, is gone through in great detail and is thoroughly well done. This chapter can not of course include the real process of editing a manuscript which requires revision or trimming or amplificaton to suit the requirements of space, or of the purpose of the editor or of the publication in which it is to appear. This is the art which cannot be acquired by instruction but only by practice and study. The conditions which circumscribe this editing process are indicated in the chapter on the field and policy of technical publications, with a special chapter on the write-up article and some instructions to authors issued by technical publications.

The rights of an author in his works are clearly defined, with the methods of protecting them by copyright, by contract between author and publisher, by laws regarding libels.

The processes of preparing illustrations for reproduction are briefly described with suggestions of special points to be observed.

The making of the book after the type is set and the cuts for illustrations are made is clearly described with many practical pointers regarding paper and binding, followed by a detailed description of the principal styles of type used in book making and the standard methods of marking errors in proofreading. The rules for making up a periodical are given as an example of the matters to be considered in determining upon the details which make up the style of the publication, whether book or periodical.

Indexing and filing books, trade publications, articles from periodicals, etc., are subjects concerning which the main principles of modern libraries are given.

The principles of criticism to be applied to the completed book are detailed as followed by the author and will be of assistance to a reader desiring to judge a book of which he is considering the purchase, whether from reviews which he may read or from a brief examination of the book itself.

One excellent chapter is that on the engineer's library and the method of selection of books and periodicals for it.

The book closes with a list of the technical indexes of articles in periodicals which are published in the United States.

If every engineer would familiarize himself with the principles laid down in this book and would apply them to his own reading and writing the engineering profession would vastly improve its standing in the estimation of the general public. In the past the engineer's education in English, in expression of his thoughts and his knowledge in forms to be understood by others was neglected and is none too thorough at the present time. His daily work is usually such that it gives him no opportunity to improve himself in this regard without spurring himself to it, something which he soon loses incentive to do unless he receives encouragement in what little he may attempt to do. Ordinarily such attempts are not so well expended that they receive the attention from readers that they deserve so that the budding author is soon discouraged. A careful study

of this book will show him where his faults lie and will give him much valuable aid in finding out how to overcome them.

Graphical Solution of Storm Sewer Problems, collected and arranged for use in the designs of permanent drainage systems. By Charles Cottingham, C. E. Three large blueprint sheets in flexible covers, $6. Published by the author, Danville, Ill.

In this publication the compiler presents in convenient form the diagrams and tables used in designing storm drainage systems by successful engineers, in such manner that results derived from their use can be easily compared.

Side by side at one end of the first sheet are diagrams for large sewers platted for Foss's formula and for Kutters' formula with n equal to 0.015, which show the usual tendency of the latter to give smaller sizes of sewers than other formulae with velocities less than 4 feet per second and larger sizes with higher velocities. These diagrams would be easier to compare if they were lettered and lines were numbered exactly alike.

The second section of this sheet gives some observations of velocities at various depths and distances from shore in open channels 4 or 5 feet deep and 18 or 20 feet wide and in arched channels of some 6 feet width and 3 to 5 feet depth running full or some 0.9 full. Scale is not given on these diagrams but the results are computed on the diagrams. It gives also rates of maximum rainfall at the University of Illinois from March, 1908, to July, 1909; and a diagram assuming that the proportion of rainfall reaching sewers varies directly as the population for 0 to 50 people per acre, with no data on which such an assumption might be based. There is also a small diagram showing the diminution in rate of increase in population as the population increases from 10,000 to 190,000; presumably the percentage of increase per annum, but the scale does not include this information nor a reference to data on which it is based.

The third section gives curves showing the relation between proportional wetted perimeter, area, hydraulic radius and proportional depth for circular and for egg-shaped sewers; and also the relation between proportional velocity, depth and discharge for sewers full, and full to various proportional parts of the full depth, also for both circular and egg-shaped sewers. There is also a diagram for correcting sewer discharges for changes in value of n in Kutter's formula. A diagram gives the cubic yards per linear foot for trenches of various widths and depths with vertical sides and two others for trenches with sides with various slopes from ½ to 1 to 4 to 1.

On the second sheet is a large diagram of capacities of sewers from 2x3 feet to 15x20 feet, presumably computed by Kutter's formula, though not so stated, and two diagrams of volumes reaching sewers from areas of various acreage from 0 to 10,000 by the Burkli-Ziegler formula with assumed constants of population, rainfall, character and slope of surface.

There are also small diagrams showing the data used in the various boroughs of New York and the formulae and constants assumed in accordance therewith and one showing the average price for pipe sewers laid in Ohio, Indiana, and Michigan in 1908 for various depths of trench and sizes of sewer from 6-inch to 24-inch diameter.

The third sheet gives the diagram showing the volume reaching the sewers used in Indianapolis, based on a modified Burkli-Ziegler formula; also for smaller areas, 0 to 3,500 acres, the storm water run off by the original Burkli-Ziegler formula for assumed constant and rainfall and corrections for other values thereof, one set being specially for country towns. There is also another diagram of relations between depth, velocity and discharge in circular and egg-shaped sewers running full and various fractions of full.

A number of small diagrams and tables which have appeared in MUNICIPAL ENGINEERING are reproduced to show the number of brick in various sized sewers, the mortar required for laying the brick, the amount of each material required for laying egg-shaped and circular brick sewers of various sizes. There are also two more diagrams showing cost of sewer work under definite specifications and one for estimating cost of manholes.

The engineer engaged in sewer work, particularly in designing storm sewers, should find the diagrams very convenient. They certainly are to the writer of this review.

The Merchant's and Seaman's Expeditious Measurer; containing a set of tables which show at one view the solid contents of all kinds of packages and casks according to their several lengths, breadths and depths; also rules for determining the contents of all sorts of casks in wine and beer measure. Sheep, 196 pp. A. L. Nash, New York.

The tables give directly contents of rectangular volumes for depths or least dimensions from one inch to four feet and for each such depth, breadths and lengths for each inch increase from the minimum, which is the same as the depth or least dimension to the maximum, which is 13 inches greater than the minimum for breadths and 5 feet 11 inches greater for lengths.

The volume of casks is given in an inserted column headed "5ths off C.," the use of which is fully explained.

Surface measurements can be taken from the pages for depth of one foot.

The Width and Arrangement of Streets; a Study in Town Planning. By Charles Mulford Robinson. Cloth, 199 pp. $2 net. The Engineering News Publishing Co., New York.

The author has had some years of experience in studying towns with a view to improving their appearance by changes in, additions to and ornamentation of their plans

and in recommending general plans for additions to existing cities. He is therefore well qualified by experience to speak of the difficulties met and to show the methods that have been used for overcoming them. He is not an engineer and his work lacks some things which that sort of education might have given him, but, on the other hand, he has escaped some of the bonds which engineers are liable to find themselves entangled in. The present volume is very closely confined to the brand of the great subject of town planning which is covered by the title, and he has covered this part of the field very completely. Occasionally there are some sentences and paragraphs which are difficult of understanding, partly, perhaps, because they were not written carefully enough, but partly because of a certain indefiniteness in the meaning of the words used; thus, in most of the book the word "street" seems to be used for the roadway, not including walks and lawns, but at times it apparently means the whole area between property lines. The engineer is accustomed to the latter use and to dividing the street into sidewalks, lawns, roadways, tracks, etc., so that he must be careful to get himself into the author's use of the word before he can be quite sure of his meaning.

The first chapter gives a good general layout of the subject of the book, showing the necessity of more careful division of streets into business, major and minor and strictly residence streets, through lines and subordinate lines and strictly neighborhood streets. The unwisdom of street adherence to standards of width and of division of street area is well shown. The relations of street width to housing and to land values for thickly settled areas and more open areas are outlined briefly, and there is a timely chapter on how to lessen the cost of improving wide streets. Main traffic streets are treated in their relations to transportation to and from business and residence districts and the surrounding country. And the need of a provision for central control of the platting and changing of streets is well shown. The best part of the book is devoted to the platting of minor residence streets in high-class districts, the development of high-class minor streets and of minor treets for small houses, and of public reservations other than streets. A good point made in the last chapter is the close connection which these reservations have with the streets coming to them and with the general street plan, and the consequent necessity, if the best service is to be secured, of considering parks, boulevards and squares at the ame time that the street plans are made.

Ten years or even five years ago this book would have been considered as highly academic, but the advances have been so rapid toward the improvement of city plans that it is treating what is now an eminently practical subject, and it should serve efficiently in arousing still stronger sentiment in favor of better plans for new urban districts and improvements in the old plans whenever changes in them are at all possible.

Bids for Garbage Plant at Paterson, N. J.

Bids for garbage and refuse disposal plant have been received at Paterson, N. J., from five sources, three presenting English destructors, including the Horsfall, Heenan-Froude and Sterling, one an American incinerator, the Decarie, and one a reduction plant. The first three provide for disposal of all refuse, the fourth omits ashes, and the last includes only garbage. The capacity used in computations of comparisons is 18,000 tons a year.

The interesting feature is the comparatively slight range in cost of plants and operation. Taking the most modern method of computation and adding together the cost of operation and of repairs, and 10 per cent. of the bid price of the plant, the highest bids of the first four bidders, omitting the reduction plant, range between $14,775 for the Decarie incinerator and $18,150 for the Horsfall destructor. Three companies submitted alternative bids, and the lowest of all was the Heenan-Froude, at $14,050, although the first cost of this plant, $81,000, is the highest, except the Horsfall, $89,500, and the reduction plant, $89,893. Wm. F. Morse, of New York, is the consulting engineer.

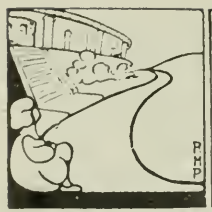
Oklahoma City Water Works Problem Settled.

At a special meeting of the board of city commissioners on November 18, the Western Wells Company, of Kiowa, Kans., was awarded the contract to furnish Oklahoma City 5,000,000 gallons of water per day at 2 cents per 1,000 gallons, with certain provisions inserted to protect the city from any loss in case there is a failure to carry out the terms of the contract, or failure in finding a sufficient water supply. The contract has been drawn by the municipal counselor's office and is ready for the signature of representatives of the company.

However, the fact that the contract was not signed has not delayed the work of the company. For two weeks it has been making the necessary tests, and machinery to complete the work has been shipped to Oklahoma City. There has been no delay, according to Commissioner Hampton, in starting the actual work of sinking the wells.

Moscow's City Pawnshop.

Fifteen years ago Moscow started a city pawnshop. Since then it has lent more than $27,000,000 on nearly 7,000,000 articles left in pawn.



ORGANIZATIONS & INDIVIDUALS

The American Association for Highway Improvement.—The American Road Builders' Convention.—The American Civic Association.—The Association for Standardizing Paving Specifications.—Calendar of Technical Meetings.—Technical Schools.—Technical Associations.—Personal Notes.

The American Association for Highway Improvement.

The first convention and good roads congress of the American Association for Highway Improvement opened with a large audience on Monday morning, November 20, and nearly five hundred registered during the day, with many in attendance who did not register. Governor Mann, of Virginia, and Mayor Richardson, of Richmond, welcomed the convention and were followed by Logan Waller Page, the president of the association, who gave a brief history of the movement resulting in the organization and the convention. He introduced Senator Martin, of Virginia, who is a strong advocate of national aid for good roads. President W. W. Finley, of the Southern railway, discussed good roads and the farmer, and J. Hampton Moore, of Pennsylvania, endorsed national aid and a Lincoln memorial highway from Gettysburg to Richmond by way of Washington.

In accord with the preceding speeches by members of Congress, Cyrus Kehr, of Knoxville, Tenn., introduced a resolution recommending the appropriation of $50,000,000 a year by the United States government for highway improvements, which was referred to the committee on resolutions.

At the afternoon session the Secretary of Agriculture presented an address, representing also the President, who was unable to be present owing to his illness. Gen. T. Coleman Du Pont described in considerable detail his plans for a great highway in Delaware, with a right-of-way 200 feet wide, and his uses for this great width. Much of it he would lease for at least a few years for cultivation, using the proceeds for maintenance of the roadway. Dr. Walter H. Page, of New York, made a few excellent points in favor of good roads, and the program was completed by an address by Senator Swanson, of Virginia, who made an eloquent appeal for support of his bill providing for an annual appropriation by Congress for good roads, and explained its provisions.

The evening was given to an entertainment by the Chamber of Commerce and the City of Richmond.

The program of the last two days was practically as follows:

Chairman's Address, by Harold Parker, formerly Chairman of Massachusetts Highway Commission.

"Macadam and Gravel Roads," by Hon. W. C. McLean, Provincial Engineer of Ontario, Toronto, Canada.

"Sand-clay and Earth Roads," by Capt. P. St. Julien Wilson, State Highway Commissioner of Virginia.

"Bituminous Roads," by Major W. W. Crosby, State Highway Engineer of Maryland.

"Brick and other Road Materials," discussion opened by Prof. Edward Orton, Dean of Engineering Department, Ohio State University.

"Road Cost and Maintenance," by Arthur H. Blanchard, Professor of Highway Engineering, Columbia University.

Address by Onward Bates, Past President of American Society of Civil Engineers.

Address by Capt. D. L. Hough, President, United Engineering and Contracting Company, and others.

Discussion: The Relation of the Road Contractor to the Engineer.

"Highway Bridges," by A. N. Johnson, State Highway Engineer of Illinois. (Illustrated.)

Address by Nelson P. Lewis, Chief Engineer of the Board of Estimates and Apportionment of New York City.

Address by J. B. Girand, Territorial Engineer of Arizona.

"Traffic Rules and Regulations," by Major Ricard Sylvester, of Washington; President International Police Association; Superintendent, Metropolitan Police, District of Columbia.

"Motor Vehicle Law of Massachusetts," by Col. William D. Sohier, of Boston.

"Review of the Automobile Industry—What it has done for Good Roads," by Col.

Charles Clifton, of Buffalo; President, Automobile Board of Trade.

"A Model State Motor Vehicle Law," by Hon. Edward Lazansky, Secretary of State of New York.

"The Motor Vehicle Law of Connecticut," by Hon. Matthew S. Rogers, Secretary of State of Connecticut.

"Forecast of the Automobile Industry," by Hugh Chalmers, Detroit.

"The Rights of Road Users in America Learned from Europe's Lessons," by Davir Beecroft, Chicago.

"The Illinois Motor Vehicle Law," by Sidney S. Gorham, Chicago.

"Quebec-Miami Highway Project," by H. D. Hadley, Chairman, McDonough Club, Plattsburgh, N. C.

"Use of Convict Labor in Road Building," by Dr. Joseph Hyde Pratt, State Geologist of North Carolina; Dr. S. W. McCallie, State Geologist of Georgia; Hon. Charles T. Lassiter, of Virginia, and others.

The feature of Wednesday was the report of the committee on resolutions of the congress, which read as follows:

Whereas, it has been the policy of our central government to aid in the development of our national resources, and to this end it has appropriated, and is appropriating public funds to meet the needs of the postal service, of agriculture and commerce, and of public defense;

Therefore, be it resolved, That this congress hereby respectfully memorializes the Congress of the United States to extend national aid to the several states of the union for the purpose of aiding and encouraging them to build and maintain good roads.

And that the chairman of this congress appoint a committee on national highway legislation, to be composed of one member and alternate for each state and territory, said member to be named by the delegation from that state at this congress; and that said committee request the co-operation of similar committees of all other organizations to assist them to harmonize the diversified opinions of the various interests now working for national aid, and endeavor to establish an agreement upon a united plan that may receive the endorsement and support of this association, and all others working for the establishment of the principle of national aid in the policies of our government.

Whereas, the highest degree of efficiency in road construction yet employed still leaves the question of maintenance the most important and serious question in the road problem, and

Whereas, this question of maintenance of public roads has not been given the careful consideration that it deserves, therefore,

Be it resolved, That this congress most earnestly urges upon all road authorities their immediate, continuous and careful attention to this most important subject; and that no appropriation or construction should ever be made without proper provision for their after maintenance.

Whereas, a large number of the states have made special appropriations for assisting the counties in building roads, and are constructing and maintaining these roads through a state highway department, and that this method has been found the most efficient to give a state a good system or roads;

Be it resolved, That we recommend to the various states not already provided therewith, the adoption of legislation, providing for state supervision of at least the main highways of the state, through a state highway department, and for state aid in the building and maintenance of such roads, by the making of liberal appropriations, raised by direct taxation or the issuance of bonds, as the best plan yet devised to promote and secure an efficient system of highways for a state, and at the same time uniformity in road legislation between the various states.

Resolved, It is to the opinion of this congress, that in order to secure desired results in road work most quickly and most efficiency, the work of both construction and maintenance of all public highways of any locality or state should be under the direction of experienced highway engineers, and that such engineers should be given all the authority necessary to justify holding them fully responsible for the results of the work.

Resolved, That this congress emphatically recommends the enactment of proper laws by all the states providing for the employment of prison labor in the improvement of the public highways.

Resolved, That this congress heartily commends the work of the department of agriculture for the betterment of the public roads of this country.

Representatives of this association and of the Road Builders and the Road Material and Machinery associations met to consider co-operation in holding conventions, and recommended the plan to their respective directorates and asked for the appointment of a committee of two from each organization to work out the details of the plan.

On the last day, after the adjournment of the congress, the American Association for Highway Improvement held a meeting and adopted a constitution and by-laws and elected as officers Logan Waller Page, president; W. C. Brown, vice-president; Lee McClung, treasurer; J. E. Pennybacker, Jr., secretary; C. P. Light, organizer; also, eight directors for three years, eight for two and seven for one.

About 750 delegates were registered at the congress, and about 100 members were present at the organization of the association.

American Road Builders' Convention.

The convention held by the American Road Builders' Association at Rochester, N. Y., November 14 to 17, was almost as large as that of the previous year, about 1,400 being registered. As usual, the attendance was largely from the state in which the convention was held, but there was considerable representation from widely separated states, as far away as California. The program was a good one, but the discussions almost always turned to the problems of New York roads.

On the first day after the usual addresses of welcome and responses, there were addresses on road subjects by Samuel Hill, former president of the Washington Good Roads Association; N. J. Bachelder, master of the National Grange, and Robert P. Hooper, president of the American Automobile Association. J. A. Bensel, state engineer of New York, discussed the problems of highway administration, and was followed by Geo. W. Cooley, state engineer of Minnesota, and Harold Parker, chairman of the Massachusetts Highway Commission.

On the second day, Nelson P. Lewis read a paper on the adaptability of roads and pavements to local conditions, a part of which is given elsewhere in this issue.

In the discussion of this paper, W. A. McLean, of Toronto, emphasized the desirability of holding the engineer to his duty to select the kind of pavement best for the street or road and not leaving it to the decision of the inexpert property owners; the effects of climate upon construction and selection of materials from the sub-soil drainage, which is most important in a cold, moist climate than in a dry climate or one with little frost, to the quality of the bituminous material used for treating the wearing surface, the effect of local supplies of material upon prices and consequently upon the economy of their use; the necessity of good grading, drainage, surfacing, and maintenance of the 90 or 95 per cent. of roads not in the first class, that the ease of feeding to the well improved roads of heavy travel may be commensurate with the ease of use of those first class roads, and at the same time keeping down the cost by not adopting more expensive methods of improvement than the traffic justifies.

This was followed by a paper by W. W. Crosby, state highway engineer of Maryland, on "Road Construction," which will also be found elsewhere in this number. Robert A. Meeker, state supervisor of New Jersey highways, in his discussion of the paper, noted the primary necessity of attention to setting slope stake and the stakes for cuts and fills before beginning the work of moving the earth. He recommended beginning excavations at the edges of the cuts at the location of the deepest cuts and filling first at the outside edge so that all parts of the fill will get the full compacting effect of the compression by the teams hauling the dirt. Stumps may be left in a fill in low ground if they will always be below the water level. Most New Jersey roads require special attention to drainage and unglazed, porous tile, 4 and 6-inch diameters, are used with open joints and pervious material in back fill, such as cinders, gravel, crushed stone, oyster shells. Many times the reconstruction of an old macadam road is not justified unless grades are reduced and flats are drained and these points are therefore emphasized. Failures in surface applications of bitumen result from lack of homogeneity in the road surface, the bitumen almost disappearing where voids are large and remaining near the surface where the structure is close. Charles Ross brings the surface to more uniform density by grouting with cement mortar; Harold Parker by letting travel run on the road for some time before applying the bitumen.

Charles Ross, street commissioner, Newton, Mass., also discussed the paper, laying stress on taking care of surface water and proper treatment of cuts in the surface. There was quite an animated discussion from the floor, showing the great diversity of practice and the desirability was expressed for still further discussion, preferably of specifications formulated by experts, that practice may be unified as much as possible.

Joseph W. Hunter, assistant commissioner of highways of Pennsylvania, presented an excellent resume of the highway laws of that state, which is abstracted on another page of this issue.

On the third day the problems of the contractors were discussed by C. A. Crane, secretary of the General Contractors' Association; F. E. Ellis, of Melrose, Mass., and E. F. VanHoesen, secretary of the Norfolk Road Builders' Association Mr. Crane criticized the law requiring that no alien labor be employed, because there is not enough native labor to supply the demand, and that requiring the payment of the current rate of wages, because there is no way of determining this. He also objected to the small salaries paid the engineering employes of the state because they were not sufficient to insure the best men. At the night session three illustrated papers were presented, by Prof. A. H. Blanchard, of Columbia University, on European roads; by Paul D. Sargent, of the United States office of Public Roads, on roads in the United States, and the chief of the bureau of town roads in New York showed the good results of the work of the road supervisors of the state in making better roads out of the ordinary roads of the state without entirely reconstructing them according to the standard specifications for state roads.

On the last day the discussion of maintenance of roads was opened by James Owen, county engineer of Essex county, New Jersey, with a paper which was an amplification of

the article by Mr. Owen in the November number of MUNICIPAL ENGINEERING. The discussion was continued by A. W. Dean, chief engineer of the Massachusetts Highway Commission, and by J. C. Travilla, street commissioner of St. Louis, whose paper was read by Mr. Meeker.

A little spice was added to the proceedings by a resolution introduced by Samuel Hill, which, in effect, called for an investigation of the United States Office of Public Roads. After it had been amended by the committee on resolutions to omit its ideas of the propriety and procedure it did not suit Mr. Hill and was withdrawn after a rather spirited discussion. On moton of C. A. Kenyon, president of the Indiana Good Roads Association, a committee of five experts was provided for to report standard specifications for maintenance of dirt, gravel, stone and bituminous macadam pavements.

The president in the course of his discussion of Mr. Hill's resolution, stated that the association had been reorganized and that he had become president on this understanding. The management has certainly improved and both delegates and exhibitors were on the whole well satisfied. The following were among the exhibitors present, some with full exhibits and some with simply headquarters for their representatives and friends:

Haywood Wagon Co., Newark, N. Y., dump wagons.

Hastings Pavement Co., 25 Broad St., New York City, asphalt blocks.

J. I. Case Threshing Machine Co., automobile road rollers, rock crushers, road graders, dump wagons, traction engines.

Glen Wagon Co., Seneca Falls, N. Y., dump cars for traction engines.

Everett Mfg. Co., Newark, N. Y., dump box.

Thew Automatic Shovel Co., Lorain, O.

C. H. Morse & Son, Rochester, N. Y., street signs.

Frick Co., Waynesboro, Pa., hauling engines.

Universal Road Machinery Co., Kingston, N. Y., stone crusher, screens and bins.

Wm. P. Tarrant, 12 Maple Ave., Saratoga Springs, N. Y., oil pump, conveying spout and spreading can.

Munnsville Plow Co., Munnsville, N. Y., cast iron culverts.

American Surety Co., 100 Broadway, New York.

Atlas Portland Cement Co., 30 Broad St., New York.

Barrett Mfg. Co., New York.

Warren Bros. Co., asphalt mixing plant, kettles, etc.

Buffalo-Pitts Co., Buffalo, N. Y., traction engines, cars, etc.

National Paving Brick Manufacturers' Association, Cleveland, O.

Wire-Cut Lug Brick Co., Conneaut, O.

Lane Bridge Co., Pointed Port, N. Y., distributing agents for Burch Plow Works Co., Crestline, O., cast iron culverts, road plows, etc.

Universal Portland Cement Co.

Bausch & Lomb Optical Co., Rochester, N. Y., surveying instruments, cameras, lenses, especially a new easily adjusted level.

Bituminized Road Co., Kansas City, Mo., "A dirt road transformed into a bituminous pavement."

Steel Protected Concrete Co., Philadelphia, Pa., Wainwright curb bar.

Acme Road Machinery Co., Frankfort, N. Y., dump wagons, etc.

Geiser Mfg. Co., Waynesboro, Pa., road rollers and hauling engines.

Knapp Machinery & Supply Co., 120 Liberty St., New York, eastern sales agents Concrete Form & Engine Co., Detroit, Mich., collapsible steel forms for concrete culverts, sewers and small bridges.

Amies Road Co., Bourse Bldg., Philadelphia, Pa., amiesite pavement.

American Asphaltum & Rubber Co., Chicago.

Barber Asphalt Paving Co., Philadelphia, Pa.

Hetherington & Berner, Indianapolis, brick rattler.

Mack Bros. Motor Car Co., Allentown, Pa., dump truck.

American Tar Co., Boston, Mass., Tarite.

Bituminous Road Implement Co., Boston, Mass., A. T. C. mixer and distributor.

The Texas Co., 17 Battery Place, New York.

Henry J. McCoy Co., 65 and 67 Dey St., New York, concrete carts and barrows, oil and asphalt distributers, tar kettles, Mullen gravel heater.

Bain Wagon Co., Kenosha, Wis., dump wagons.

United States Wood Preserving Co., 165 Broadway, New York, wood blocks.

International Harvester Co., gasoline traction engine.

Galion Iron Works Co., Galion, O., United Construction Co., Albany, N. Y., agents, dump wagons and corrugated and cast iron culverts and road scraper.

Sun Co., Philadelphia, Pa., asphalt and asphaltic oil.

A. Burlingame Co., Worcester, Mass., H-P. spreader for bituminous road material.

Standard Oil Co. of New York, 26 Broadway, New York, road oils.

Buffalo Steam Roller Co., Buffalo, N. Y., cable roller, scarifier, Buffalo-Pitts road rollers.

Standard Mfg. Co., Worcester, Mass., Johnston Oil and Tar Spraying Co.

Ohio Road Machinery Co., Canton, O., road scarifier and grader.

R. D. Wood & Co., Philadelphia, Pa., cast iron pipe for culverts, etc.

Watson Wagon Co., Conestoga, N. Y., dump wagons.

Marion Steam Shovel Co., Marion, O.

Huber Mfg. Co., Marion, O., road roller.

National Mixer Co., Rochester, N. Y., small portable concrete mixer.

Eagle Wagon Works, Auburn, N. Y.

Rocmac Road Corporation of America, N. Tonawanda, N. Y., and Port Arthur, Ont., Rocmac binder and pavement.

Dolarway Paving Co., New York and Chicago.

Troy Wagon Works Co., Troy, N. Y.

Columbia Wagon Co., Columbia, Pa.

Beckley Perforating Co., Garwood, N. J., screens for stone crushers.

J. C. Marriott, New York, curb conduit.

J. Y. McClintock, Rochester, N. Y., reinforced concrete guard rail.

The American Civic Association.

Planning to secure the creation of a federal bureau of national parks, to be an adjunct of the department of the interior, in which project the co-operation of President Taft and of Secretary of the Interior Walter L. Fisher already is assured, and in general to give added impetus to the movement for "A More Beautiful America," the American Civic Association will hold its seventh annual convention in Washington, December 13, 14 and 15. Every phase of civic improvement work will be given consideration during the meetings.

Secretary Fisher will preside over the evening session of December 13, when the needs of the national parks will be presented. J. Horace McFarland, of Harrisburg, Pa., president of the association, in his annual address will answer the question, "Are National Parks Worth While?" and will urge upon the congress the creation of a federal bureau of national parks. The creation and maintenance by the states of state recreation reservations will be discussed, and reports will be received of advances along this line during the past year.

In the city planning sessions experts and business men will speak from their own experiences, to show the wisdom of applying system to the development of the aesthetic city. Major William V. Judson, U. S. A. engineer commissioner of the District of Columbia, will make an address on "Washington, the Model City."

The American Civic Association is a national organization engaged in arousing and assisting cities and communities in important efforts for their physical development.

The Association for Standardizing Paving Specifications.

The third annual meeting of the Association for Standardizing Paving Specifications will be held at the Hotel Grunewald, New Orleans, La. The date of the meeting has been changed to the week of January 8 to 13, inclusive, 1912. Delegates may make reservations through Capt. W. J. Hardee, city engineer, City Hall, New Orleans, La. In order that the work of the various committees may be evpedited and just criticism avoided if possible, the association requests that any one advocating a change in the specifications as published in the copyrighted proceedings of the second annual meeting held in New York this year, address, at the earliest possible date, the proper chairman suggesting, in writing, with the reasons therefor. All communications addressed to the secretary after January 4 should be directed to the Hotel Grunewald. John B. Hittell, secretary-treasurer, 5917 Winthorp avenue, Chicago, Ill.

Calendar of Technical Meetings.

American Public Health Association.—Annual Convention, Havana, Cuba, December 4-9. William C. Woodward, M. D., secretary, District Bldg., Washington, D. C.

Association of American Portland Cement Manufacturers.—Annual Meeting, New York City, December 11-13. Percy H. Wilson, secretary, Land Title Bldg., Philadelphia, Pa.

American Institute of Architects.—Annual Convention, Washington, D. C., December 12-14. Glenn Brown, secretary, The Octagon, Washington, D. C.

American Institute of Chemical Engineers.—Annual Meeting, Washington, D. C., December 20-22. J. C. Olsen, secretary, Polytechnic Institute, Brooklyn, N. Y.

American Society of Agricultural Engineers.—Annual Meeting at St. Paul, Minn., December 27-29. J. B. Davidson, secretary, Ames, Ia.

American Association for the Advancement of Science.—Annual Meeting, Washington, D. C., December 27-January 3. L. O. Howard, secretary, Smithsonian Institute, Washington, D. C.

Pacific Northwest Society of Engineers.—Annual Meeting at Seattle, Wash., January 6. Joseph Jacobs, secretary, 803 Central Bldg., Seattle, Wash.

American Society of Engineering Contractors.—Annual Meeting at New York City, January 9. J. R. Wemlinger, secretary, 13 Park Row, New York City.

Second Annual New York Cement Show.—Madison Square Garden, January 29-February 3. J. P. Beck, general manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Fifth Annual Chicago Cement Show.—Coliseum, February 21-28. J. P. Beck, general manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

First Annual Kansas City Cement Show.—Convention Hall, March 14-21. J. P. Beck, general manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Technical Schools.

A revision of the old courses and the addition of two new courses in the department of mechanical engineering has been proposed by Prof. E. F. Miller, of the Massachusetts Institute of Technology. In brief, the changes include lengthening the course in hydraulics, more work in electrical engineering, a more complete course in refrigeration, additional studies of the

small gas engine and sufficient German to read German scientific periodicals.

Bruce W. Benedict, for several years in the motive power department of the Atchison, Topeka & Santa Fe Railway Co., has been appointed director of the shop laboratories in the department of mechanical engineering at the University of Illinois. Mr. Benedict was born in Buda, Ill., in December, 1876. He graduated from the University of Nebraska in the class of 1901.

Prof. Emory R. Johnson, of the University of Pennsylvania, has been appointed by President Taft, special commissioner to investigate the prospective traffic through the Panama canal, for the purpose of fixing upon an equitable tonnage rate.

"Tests of Nickel-Steel Riveted Joints," by Arthur N. Talbot and Herbert F. Moore, has just been issued as Bulletin No. 49 of the Engineering Experiment Station of the University of Illinois. This bulletin describes tests of riveted joints of nickel-steel in tension and in alternated tension and compression. The slip of rivets and the strength of joints were determined. From the tests, the general conclusion is drawn that in riveted joints, designed on the basis of ultimate strength, the use of nickel-steel may be of advantage; but that in riveted joints designed on the basis of frictional hold of rivets, while it may be advantageous to use nickel-steel for the plates, rivets of ordinary steel seem to resist slip as well as rivets of nickel-steel.

The following non-resident lecturers in highway engineering for 1911-1912 have been appointed at Columbia University: John A. Bensel, M. Am. Soc. C. E., New York state engineer, Albany, N. Y.; Walter W. Crosby, M. Am. Soc. C. E., chief engineer Maryland State Roads Commission, Baltimore, Md.; A. W. Dow, chemical and consulting paving engineer, New York City; Walter H. Fulweiler, Assoc. M. Am. Soc. C. E., chief chemist United Gas Improvement Co., Philadelphia, Pa.; John M. Goodell, Assoc. Am. Soc. C. E., editor-in-chief Engineering Record, New York City; Nelson P. Lewis, M. Am. Soc. C. E., chief engineer board of estimate and apportionment, New York City; Logan W. Page, M. Am. Soc. C. E., director United States office of public roads, Washington, D. C.; Harold Parker, M. Am. Soc. C. E., chairman Massachusetts Highway Commission, Boston, Mass.; Charles P. Price, Assoc. Am. Soc. C. E., manager American Tar Co., Malden, Mass.; H. B. Pullar, chief chemist American Asphaltum and Rubber Co., Chicago, Ill.; John R. Rablin, M. Am. Soc. C. E., chief engineer Massachusetts Metropolitan Park Commission, Boston, Mass.; Clifford Richardson, M. Am. Soc. C. E., consulting engineer, New York City; Phillip P. Sharples, chief chemist, Barrett Manufacturing Co., Boston, Mass.; Francis P. Smith, M. Am. Soc. C. E., chemical and consulting paving engineer, New York City; Albert Sommer, Assoc. Am. Soc. C. E., consulting chemist, New York City; George W. Tillson, M. Am. Soc. C. E., consulting engineer Borough of Brooklyn, New York City.

Technical Associations.

At a recent meeting of the Rochester Engineering Society, John C. Parker, of the Rochester Railway and Electric Co., delivered an address on the subject "Compensation for Engineering Services," in which he stated that the engineers are the poorest paid professional men.

At the regular monthly meeting of the American Society of Engineer-Draftsmen, held in the Engineering Societies' Bldg., New York City, November 16, papers were presented on "Construction Work West of the Missouri River," by Walter Dalton, and on "Comprehensive Drafting and Lettering," by Charles W. Reinhardt, chief draftsman, Engineering News.

At a regular meeting of the Cleveland Engineering Society, held on November 14, the following papers on water works subjects were presented: "Purification by Filtration," R. Winthorp Pratt, Cleveland, O.; "Purification by Chemicals, and Interpretation of Water Analyses," Dr. R. G. Perkins, Western Reserve Medical College; "Purification by Ozone,' R. M. Leggett, The National Air Purifying Co., Ann Arbor, Mich.; "Purification by Electricity," D. D. Vincent, The Electra Pure Water Co.

At a meeting of the Brooklyn Engineers' Club, on November 9, a resolution requesting Gov. John A. Dix to appoint an engineer to the New York City public service commission, when the next vacancy occurs, February 1, 1912. In discusing the resolution, it was pointed out by referring to specific recent cases that administrative offices requiring an engineer's training are usually filled by lawyers or politicians. The resolution was carried unanimously, and the officers of the club subsequently forwarded a copy to the governor. The nominees for president and secretary are W. T. Donnelly and Joseph Strachan. The annual meeting will be held December 14.

The American Society for Promoting Efficiency is being organized by a committee, among whom are the following: T. C. DuPont, Wilmington, Del.; P. W. Gates, Chicago, Ill.; Henry W. Tawne, New York City; Harrington Emerson, New York City; John Hays Hammond, New York City; Alexander C. Humphreys, New York City; William Kent, New York City; John F. Wallace, New York City; J. G. White, New York City; Edmund J. James, Champaign, Ill.; Herman Schneider, Cincinnati, O.; Charles B. Going, New York City, and Charles Kirchhoff, New York City. The object of the society is "to promote efficiency in commercial and industrial enterprises of all kinds, including public service corporations." H. F. J. Porter, 1 Madison avenue, New York City, is secretary.

The Engineers' Club of Baltimore has undertaken the publication of a monthly "Journal," of which the first issue, November, 1911, has recently been published. It contains articles on "The Public Service Commission of Maryland," by Charles E. Phelps, and on "Baltimore as an Industrial City; and the Factory Site Commission," by A. S. Goldsborough; editorials on "The Journal" and "The Engineers' Club," and a complete reprint of the club's proposed charter and amended by-laws. The editors are Oscar F. Lackey, John H. Milburn and John K. Flick.

The Texas Good Roads Association was organized at a meeting held in Dallas, Tex., on October 27. The following officers were elected: President, O. E. Dunlap, Waxanachie; first vice-president, John Warren, San Antonio; second vice-president, Judge Cato Sells, Celbourne; third vice-president, Homer D. Wade, Waco; general secretary, George W. Baker, Dallas; general engineer, Prof. R. J. Potts, College Station.

At a regular meeting of the Municipal Engineers of the City of New York, Calvin Tomkins, commissioner of docks and ferries, city of New York, presented an illustrated paper on "The Port of New York."

The twelfth annual convention of the Washington State Good Roads Association was held at Wenatchee, Wash., on October 19, 20 and 21. The following is a brief summary of the convention proceedings: Recommended four state roads to be built by state bonds. Ordered the codification of existing state road laws. Indorsed convict labor on roads in city, county and state penal institutions. Recommended that where a convict is about to leave such an institution without funds he should be permitted to work on roads to gain money to face the world. Indorsed the fundamental principles of the present state road law. Recommended that instead of one payment for road assessment it be made in not less than five payments and at 6 per cent. interest. Asked the state highway commissioner to prepare map, showing system of existing and proposed roads for distribution. Indorsed a memorial to congress asking relief for western Washington in the Olympic reserve, and asking that the national government build roads to the summits of the national parks. Recommended to county commissioners that good county roads be constructed from trade centers, and that branch roads be improved in proportion to their importance. Resolved that no permanent road should be built on more than a 5 per cent. grade. Appointed a committee to investigate the new pavement in Scioto county, Ohio. Formally made Samuel Hill honorary life president. The following officers were elected for the ensuing year: S. A. Perkins, Tacoma, president; John P. Hartman, Seattle, firse vice-president; W. T. Clark, Wanatchee, second vice-president; L. L. Bush, Pacific, third vice-president; W. F. Marble, fourth vice-president; D. B. Hillop, Klickitat, fifth vice-president; W. L. Steinmeg, North Yakima, treasurer.

Personal Notes.

John M. Hackett has been elected as city engineer of Dunkirk, N. Y.

Edward Cassidy, Pueblo, Col., has opened an office for the practice of civil and hydraulic engineering.

R. H. Thomson, since 1892 city engineer of Seattle, Wash., has been elected engineer of the Port of Seattle.

Ross Canterbury has resigned as city engineer of Peoria, Ill., to take up private engineering construction.

Walter McCulloh, consulting engineer of the New York State Water Supply Commission, has resigned.

C. G. Reel, of Kingston, N. Y., has been appointed superintendent of highways of the state of New York, succeeding the late William H. Catlin, who died recently. Mr. Reel has been serving recently as first deputy in the state highway department.

Walter H. Evans, formerly superintendent of track and roadway of the Indiana Union Traction Co., at Anderson, Ind., has been appointed manager of the motor gear department of the Edgar Allen American Manganese Steel Co., with headquarters in Chicago, Ill.

Prevost Hubbard, chief of the division of roads and pavements of the Institute of Industrial Research, has been appointed lecturer in engineering chemistry at Columbia University. He will conduct the courses in highway engineering.

Beginning with the November number, the Twentieth Century Magazine will be edited by Charles Zueblin. B. O. Flower, the former editor, is still a member of the board of directors, and will be a frequent contributor. He has resigned to take up independent literary work.

DeWitt V. Moore, C. E., formerly of the Moore-Mansfield Construction Co., and the Mansfield Engineering Co., has disposed of his interests in the above concerns, and in the future will maintain an individual office as consulting engineer and contractor. In connection with these offices an association has been formed with the W. C. Halsted Co., building contractors, with offices at 513-16 Indiana Pythian Bldg., Indianapolis, Ind.

The city of Muskogee, Okla., with mutual consent, has abrogated its contract with Alexander Potter to act simply as an advisory engineer on the improved water supply sewerage system and garbage disposal plant now under construction, and has entered into a new contract with him, placing the entire engineering work under his direction, control and responsibility.

A new engineering organization for the municipal work of Jacksonville, Fla., has been formed, similar to that of Washington, and several members of the Washington engineering department have been appointed to the principal positions. Capt. Edward M. Markham, Corps of Engineers, U. S. A., who is serving as assistant to the engineer commissioner of the District of Columbia, is retained as consulting engineer, but will also continue in his present connection. L. D. Smoot, formerly assistant engineer of highways at Washington, is appointed city engineer of Jacksonville. J. R. Whelpley, formerly assistant engineer in the sewer department at Washington, will be in charge of sewer and water works construction; J. E. Ballinger will be engineer of highways, and R. Y. Middleton, chief draftsman.

MACHINERY AND TRADE

National Association of Road Material and Machinery Manufacturers.

At the Richmond Road Congress, November 21, there was formed the National Association of Road Material and Machinery Manufacturers. The charter members of the association include the leading concerns in the United States engaged in the road building industry. Member companies must be road material or machinery manufacturers, and not primarily contractors or dealers.

W. T. Beatty, of the Austin Manufacturing Co., Chicago, was elected president of the association; S. Jones Philips, of the American Road Machinery Co., vice-president; Daniel T. Pierce, of the Barber Asphalt Paving Co., secretary and treasurer. The office of the association will be at 32 Liberty street, New York City.

Those who have been elected and accepted for representation on the board of directors of the association are: Nat Tyler, Jr., Monarch Road Roller Co.; B. C. Hvass, Charles Hvass Co.; H. P. Goodling, A. B. Farquhar Co.; Henry Fisher, Standard Oil Co.; Charles P. Price, American Tar Co.; R. K. Pierce, Solvay Process Co., and J. S. Robeson, Robeson Process Co. The Texas Co., Studebaker Corporation, Watson Wagon Co. and four other manufacturers will have representation on the board.

The annual meetings of the association will be held in connection with a yearly exhibit, under the auspices of the association. It is hoped that arrangements can be made for the annual exhibit at joint conventions of the principal good roads organizations.

A New Design of Controllable Concrete Dump Bucket.

The Ransome Concrete Machinery Co., Bucket Dept., Dunellen, N. J., has just put on the market a new design of concrete dump bucket that is especially adapted for placing concrete in thin walls, even as thin as 3-inch, without waste or extra handling, while at the same time it is a generally useful bucket and has ample volume.

The section of the bucket is a right-angle triangle with the vertical side free from all mechanism. The dumping devices are located on the hypotenuse and thus the operation of the bucket is easily effected without interference from projecting steel reinforcement rods or forms. In operation the vertical side is brought up against the steel work.

The dumping device is simple, and readily controlled by a handle operating a cam that bears on an equal arm lever that connects by another lever to the drop bottom. The operator has ready control over the amount of concrete to be placed and by moving the bucket forwards and backwards can place concrete in thin layers as desired. It will be noticed that this bucket can be placed directly against vertical steel rods throwing the contents of the bucket between them. The shape of the drop bottom is such that with a little experience the operator can cast the concrete through a steel system from 4 to 6 feet wide.

The straight side gives a clear fall by gravity to the concrete which completely clears the bucket, thus reducing to a minimum the time for ordinary cleaning operation. When desired the bucket is furnished with legs so that it can be set down in an upright position. The bucket is fully patented.

It has been used with much success by contractors J. B. Smith & Co., in erecting the inclined reinforced concrete abutments for the overhead double track crossing on the Western and Atlantic Railway at McCarty, Tenn.

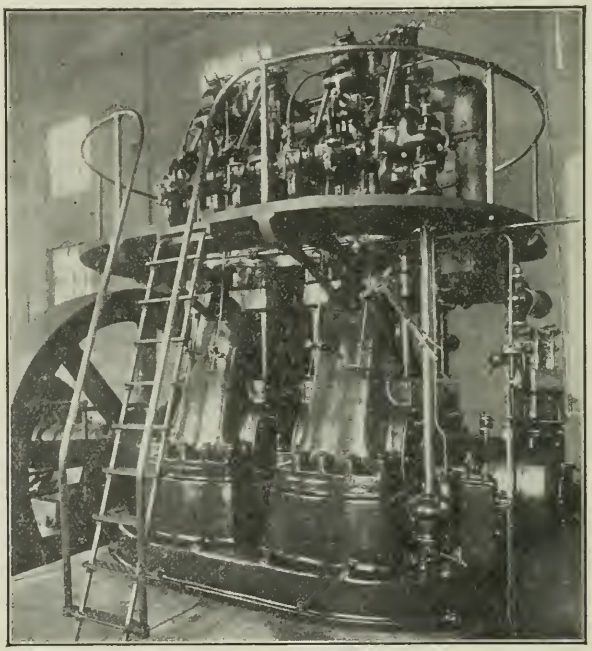
The Atlas Crude Oil Engine.

The Diesel type of crude-oil engine has been the object of widespread interest of the engineering fraternity for years. Its remarkable fuel economy is probably not equalled by any other type of prime mover, and announcement of the fact that the Atlas Engine Works, of Indianapolis, is taking up its manufacture, embodying in the new machine some important improvements, mainly along lines of simplification of design and making all working parts accessible, is of interest. This concern will market this type of engine under the name "Atlas Crude-Oil Engine," and will build in sizes of 300, 450 and 600 B. H. P. (2, 3 and 4 vertical cylinders.)

Since this internal combustion engine has been so successful in operation abroad and has become so generally adopted, it is only natural that it should be of great in-

terest to manufacturers in this country. Engines of the Diesel type are not only in general use in England, Germany, France, Belgium and Russia, but are now being installed in war and merchant vessels. Prince Henry, of Germany, recently predicted that within ten years all warships will be operated by engines of the Diesel type. It occupies much less space than the old-time boiler and engine equipment, and the gain in cargo capacity is important.

The distinctive feature of this type of engine is, of course, its wonderful economy and absolute dependability. The simplicity of the Atlas design of this type of engine figured at two cents a gallon (the present average price) would cost $1.35 per ten-hour day for 100 B. H. P. per hour, or, $2.00 per day for 100 K. W. per hour. Nothing can equal it unless it be water power, and then only when the natural advantages are practically ideal. It consumes only about one-half of the heat that a producer gas plant would and about 20 per cent. of that used by a steam plant. It does away with boilers and all fire room expense, doubts about coal supply, ashes, and the time wasted in getting up steam. Furthermore, it is sold on definite guarantees of fuel consumption.



THE ATLAS CRUDE OIL ENGINE.

is interesting. The entire valve mechanism is accessible from the outside, and the only working parts in the crank case are the crank and connecting rod, thoroughly lubricated with the splash. The cylinder head can be removed without disturbing any of the valves or valve adjustment, all other adjustments can be made easily and quickly, most of them while the engine is in operation. The Diesel principle of fuel combustion is followed closely. There is no complication of parts. Fuel is controlled automatically, so closely that the amount used at half load is just about one-half that used at full load, with an unusually high efficiency on light loads. The engine develops one brake horsepower on less than one-half pound of fuel of average calorific value and weight, which,

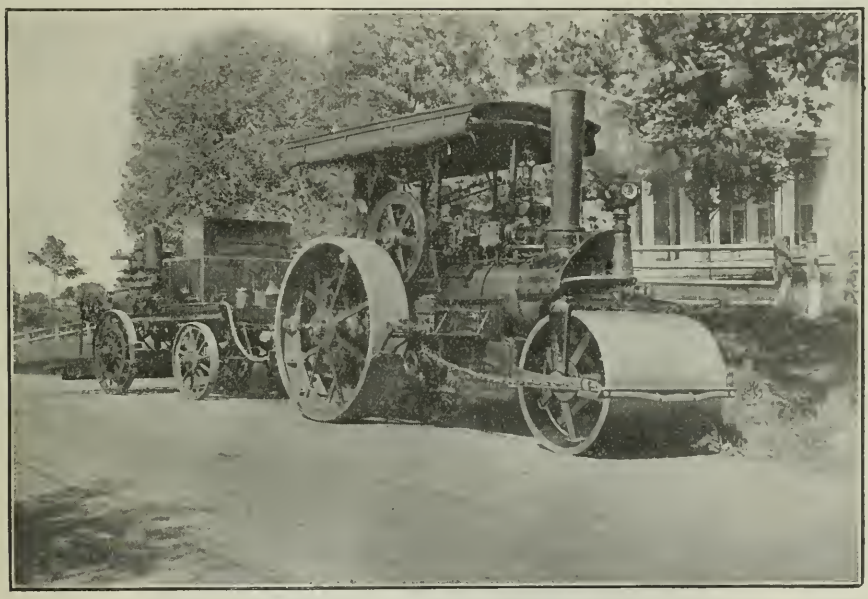
A very interesting test has recently been made on one of these machines by C. E. Sargent, M. E., of Chicago, and a copy of it, together with a brief bulletin describing the engine, will be worth reading by anyone interested in the problem of economical power. Both may be had upon application to the Atlas Engine Works, Indianapolis, Ind.

Eclipse Mixers in Chicago.

The recent street paving work in the city of Chicago attracted considerable attention in view of the novel method of disposing of the old granite blocks which were torn up and crushed in a stone crusher and deposited in piles on the street. These crushed granite blocks together with the

screenings from same and sand were mixed together and formed the concrete base for the new paving, which was built in accordance with the specifications of the Local Board of Improvements and consists of a concrete base eight inches in thickness, a 1-inch cushion of sand and a surface of 4-inch creosoted pine blocks. By using the granite blocks in this way the expense of removing same and the cost of the crushed stone as well as that of hauling the crushed stone was avoided. Two Eclipse Low Charging Concrete Mixers, manufactured by the Standard Scale and Supply Co., were used to rush the work, several hundred yards of concrete being placed every day with each machine. The mixers were operated on the street between the car tracks and the curb and were moved forward as the work progressed.

An interesting point is that the contract was completed and the last of the wood block pavement placed in position late Saturday evening, November 11th, the day before a severe storm and cold wave hit Chicago.



THE BUFFALO-PITTS STEAM ROLLER.

Differing Uses of the Steam Roller.

The many uses to which a first-class steam roller like the Buffalo Pitts, can be put are admirably illustrated and set forth in a catalogue recently issued by the Buffalo Steam Roller Company, of Buffalo, N. Y. It points to the fact that such a machine can be used in all forms of highway improvement and can perform in such work many different offices. It can be used as stationary power for running a stone crusher and can haul a portable crushing outfit from place to place. It is also most economical for hauling road material in wagon trains. For country highways it can pull road graders and roll the earth at the same time. For macadam roads it will roll the subsoil, the Telford base, the courses of broken stone and the bituminous surface. Old roads can be picked up or scarified, reshaped and rolled down again, all with the steam roller and with very little expense. They call particular attention to the small cost of operation and to the fact that a steam roller can be used to much better advantage than a gasoline machine as the steam from the boiler is often needed for running rock drills and steam pumps and it is absolutely necessary for heating tar or oil tanks when spreading bituminous material. The delay in starting a gasoline machine on cold mornings, the excessive vibrations when the engine is running and the various annoyances incidental to operating a gasoline machine are absent in a steam roller.

As most gasoline rollers have but a single cylinder with only one explosion for every two revolutions of the crank shaft, only one-eighth as many running impulses are given to the driving mechanism as in the case of the double engine steam roller, the crank shaft of which receives four impulses for every revolution. Consequently

the strains upon the driving gear of the gasoline machine are many times more severe than those put upon the driving gear of a steam roller. The result is the much longer life of the steam machine.

The Buffalo Pitts was the first steam roller manufactured in America that is still on the market. As it has had the longest period in which to be brought to perfection by its manufacturers, its efficiency and durability have been proven.

Change of Address of the Birmingham Office of the H. W. Johns-Manville Co.

Due to the fast increasing business in Birmingham, Ala., the H. W. Johns-Manville Co. has found it necessary to change the location of its office from 1220 Empire Bldg. to 606 Chamber of Commerce Bldg., this address being better adapted for its requirements. This office will continue under the management of Mr. W. H. Fleming, who was connected with the New Orleans branch of this company for a considerable time. A complete line of the J-M asbestos and magnesia products, electrical supplies, packings, etc., will be handled from this office.

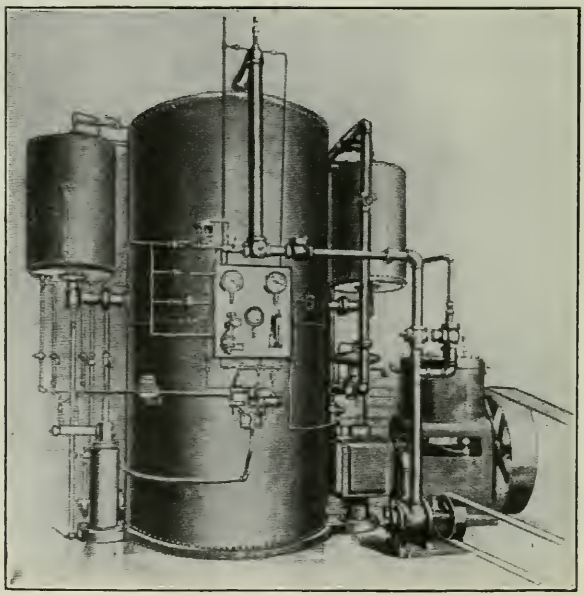
Change of Address of A. Eugene Michel.

The main offices of A. Eugene Michel and staff, advertising engineers, have been moved into the Park Row Bldg., 21 Park Row, New York City, where larger space has been secured, as necessitated by constantly increasing business. Temporarily the photo retouching and illustrating department will remain in the Hudson Terminal Bldg., but all business will be managed from the new offices.

A Practical Small Town Gas Plant.

The question of the efficient and economical lighting of small towns and villages, from a central plant, has not until very recently been satisfactorily settled. Various schemes for manufacturing gas, such as acetylene and gasoline plants, have been tried, but have in the main been entirely unsatisfactory.

The Practical Gas Engine and Machine Works, 1916 State street, Chicago, have produced a gas plant known as the "Practical Alternating Cold Process Gas Machine," which is giving entire satisfaction as a small town plant; manufacturing gas for both light and fuel at a price on a par with the large city plants. There are at present about 160 of these plants in operation, and entire satisfaction with all features of the machine has been expressed. As an economical plant for a town of from 400 to 1,500 population, it has no superior. The following comparison between a small electric plant and one of the cold process gas machines serves to illustrate the economy of the machine:



THE PRACTICAL ALTERNATING COLD PROCESS GAS MACHINE.

An 1,800 alternating cold process gas

works will supply gas for 1,8000 full 70-c.p. light, making in all, lights for 126,000 c.p., requiring only a 12-h.p. engine to drive the compressor, blower, etc., and requiring about two hours' run morning and night.

To operate an electric light plant to supply 1,800 lamps of 16 c.p., requires 180-h.p. engine; and if the electric light plant should furnish the same amount of candle power as the 1,800-light cold process gas works, it would need to have the push of an engine of 787 h.p.

A comparison between the cold process machine and an acetylene plant is given by S. F. Critz, of Riverside, Ia.: "The cost compared to acetylene for the same amount of light is half or less; with no dirt or smoke, blacking of mantle, but a clean, steady white light. There are three discarded acetylene gas machines in our town of Riverside, all of which can be bought at less than one-fourth of their cost."

The Practical Gas Engine and Machine Works install the plants complete. Ordinarily for a town of 1,200 population a plant can be installed for $8,500 complete, and in running order. This includes the building which is composed of brick, composite rubberoid roof, 11 ft. high, 24 ft. wide, 24 ft. deep, concrete floor and the machinery installed there on concrete foundations; also the mains running in size from 3 to 1¼ inches, the length of which is about 10,000 ft. For smaller towns, requiring 5,000 to 6,000 ft., the price of the plant would be in proportion to the above, perhaps $7,500.

The accompanying illustration shows a typical installation.

Trade Publications.

The Warren Bros. Co., 59 Temple Place, Boston, Mass., has for distribution an illustrated booklet on "Warrenite," a bituminous concrete surface for country roadways. Examples are given of roads built of this material, which were constructed in 1902 and are still in excellent condition. The material has been extensively used on Eastern road work, over 453,000 sq. yds. having been laid previous to October 1, 1911.

The monthly bulletin of the Universial Portland Cement Co., Chicago, Ill., contains among other matters of interest a description with illustrations of some of the concrete bridges in the parks of Minneapolis, Minn.

The Goulds Manufacturing Co., Seneca Falls, N. Y., has issued Bulletin No. 101, which fully describes its triplex plunger pumps. The pumps shown are designed on the same general lines throughout, but details of construction are varied somewhat under different working conditions and pressures, the latter ranging from 130 lbs. or 300 ft. elevation to 200 lbs. or 460 ft. elevation. This bulletin is prepared for free distribution among those interested.

The Jeffrey Manufacturing Co., Columbus, O., has an exceptionally complete catalog on power and transmission. It contains a great amount of valuable technical information in a condensed but complete form. Besides listing dimensions and sizes of every part in this line, there is descriptive matter on the horse powers of steel shafting, standard methods of key seating, sizes and dimensions of couplings, hangers, pillow blocks, counter shafts, belt tighteners, clutches and quills. A feature is made of the Jeffrey improved split iron pulley, which may be readily clamped on the shaft without disturbing any other equipment, or may easily be removed from the shaft when necessary. A complete line of wood split pulleys and a very complete description and information on rope driving are shown. In addition there are quite a number of details in the rear part of the book, including horse power of belts, method of calculating bending and torsional moments for shafts, which are valuable to the engineering fraternity.

Bulletin No. 20, dealing with the economy improvements and operating conveniences of Kerr turbo-blowers and turbo-pumps, particularly in gas plant service, has just been issued by the Kerr Turbine Co., Wellsville, N. Y. This bulletin contains interesting comparisons with other driving methods for the same work, and illustrates a number of installations. "Be Ready for the Long Dark Nights" is the title of Bulletin No. 22, just issued by the same company, describing and illustrating installations of their turbo-generator sets for lighting.

The International Harvester Co., Chicago, Ill., has printed for free distribution a new booklet entitled "The Story of Bread." This booklet comprises 28 pages and tells the story of bread in an interesting and instructive way.

The Schutte & Koerting Co., Philadelphia, Pa., has a new catalogue, section 6-B, on Koerting centrifugal spray nozzles for recooling condensing water, also gas engine jacket water, etc; and a revised bulletin, 5-B, on multi-jet condensers.

The DeLaval Steam Turbine Co., Trenton, N. J., has a small but very complete and interesting booklet, describing a steam turbine for driving direct current generators. A discussion of the different types of steam turbines and their comparative merits is also given. Complete illustration by photographs and line drawings serve to give a clear idea of the points discussed. The spiral gear feature of the DeLaval turbine is fully described.

There is probably no more important subject in connection with the manufacture of concrete than that of properly selecting and proportioning the aggregates. The Vulcan Portland Cement Co., Fifth avenue, New York City, has just issued the third edition of its twenty-six page pamphlet, entitled "The Selection and Proportion of Aggregate for Concrete.

The Wemlinger Steel Piling Co., 11 Broadway, New York, N. Y., has a twenty-page booklet, describing its corrugated steel sheet piling and its use on various classes of work.

The H. W. Clark Co., Mattoon, Ill., has a card suggesting the advantages of the Clark meter box and the "Texsagon" coupling for use at the meter. A rapid and secure meter installation is demonstarted by a series of photographs.

The Reinforced Concrete Pipe Co., San Francisco, Cal., has a very complete and excellently illustrated publication, showing the adaptability of reinforced concrete pipe for sewers, both sanitary and storm, and for water conduits. Examples are shown of numerous pressure conduits, siphons and pipe lines of 30, 36 and 42 inches in diameter. Tests and details are fully explained in the book.

Merritt & Co., Camden, N. J. have a publication fully describing the Priestman ejector system, which was noted in a recent issue of MUNICIPAL ENGINEERING.

IMPROVEMENT AND CONTRACTING NEWS

PMP

ROADS AND PAVEMENTS.

BIDS REQUESTED.

St. Elmo, Ill.—P. E. Fletcher, city engineer, desires prices f. o. b., St. Elmo, on paving brick, grates for catch-basins and sewer tile.

Brazil, Ind.—Dec. 14, 10 a. m. Constructing gravel or macadam road in Boone and Webster townships. E. A. Staggs, auditor.

Columbus, Ind.—Dec. 14, 10 a. m. Constructing macadamized road in Clisty township and gravel roads in Jackson township. Philip J. Sater, auditor.

Huntington, Ind.—Dec. 18, 10 a. m. Constructing gravel road in Huntington township. John W. Weaver, auditor.

Lafayette, Ind.—Dec. 6, 10 a. m. Constructing three gravel roads. Geo. W. Baxter, auditor.

Lawrenceburg, Ind.—Dec. 5, 12 m. Improving highways in Jackson township. William F. Fagaly, auditor.

Logansport, Ind.—Dec 5, 10 a. m. Constructing stone road in Miami township. J. E. Wallace, auditor.

Logansport, Ind.—Dec. 5, 10 a. m. Constructing gravel road in Clinton township. J. E. Wallace, auditor.

Paoli, Ind.—Dec. 5, 2 p. m. Constructing a road in Paoli township. Alvin B. Ham, auditor.

Valparaiso, Ind.—Dec. 5, 10 a. m. Constructing gravel road in Portage and Boone townships. C. A. Blachley, auditor.

Winamac, Ind.—Dec. 5, 12 m. Constructing public highway. W. E. Munchenburg, auditor.

New Orleans, La.—Dec. 11. Constructing 9½ miles of highway between New Iberia and Jeanerette. Frank M. Kerr, state engineer, 104 New Orleans Court.

Winona, Minn.—Jan. 10, 1912. Constructing about twenty miles of macadam roadway. Jos. Winczwsky, county auditor.

CONTRACTS AWARDED.

Birmingham, Ala.—The following paving contracts have been awarded: Macadam on Thirteenth street, to the Southern Asphalt Co., $3,254; macadam on Ensley to the same, $15,031; Third avenue, to Paul Richter, $1,408.

Bakersfield, Cal. — Reconstructing the Coles Levee road, to G. B. Mosher, $14,010.

Madera, Cal.—Paving construction to the Ransome-Crumme Co., Oakland, Cal., $96,-110.

Quincy, Cal.—Constructing the Seneca road, to Geo. M. White, $7,680.

Richmond, Cal.—Paving Twenty-third street, to L. L. Page, $4,650; paving Neamin avenue, to Galbraith Bros., $7,892.

Hartford, Conn.—The following state road contracts have been awarded: 10,950 feet in the town of Plymouth, to the Pierson Engineering and Construction Co., Bristol, Conn.; 9,564 feet in Berkamsted, to Caesar A. Rossi, of Torrington, Conn.; 6,009 feet in Southington, to John F. Knapp, of Belden Hill, Conn.; 7,860 feet in Sommers, to A. B. Bridges Sons Co., of Hazardville, Conn.; 14,150 feet in Wolcott, to Joseph E. Aloia, of Cromwell, Conn.

Lewiston, Ida.—Laying 25,000 sq. yds. of paving, to the Inland Empire Hassam Paving Co., of Spokane, Wash.

East St. Louis, Ill.—The following street improvement contracts have been awarded: Twenty-first street, to J. P. Kelly, $7,768; Eighteenth street, to same, $7,532; Broadway, to Meyer & Thomas, $29,125; Exchange avenue, to the Meyers Construction Co., $26,022.

Rantoul, Ill.—Paving contracts have been awarded to H. C. Finley, of Hoopeston, Ill., $24,000.

Logansport, Ind.—Constructing the Hoffman road, to J. H. Novinger, $10,680.

Clinton, Ia.—Constructing 74,960 sq. ft. of cement walk, to Carey & Son.

Wichita, Kan.—The following street improvement contracts have been awarded: Mentor avenue, to H. L. Miles; constructing curb and gutter on Mentor street, to A. T. Buckeridge; constructing curb and gutter on University avenue, to Myers & Newcomb; paving Fountain avenue, to the Rackliff-Gibson Construction Co.; paving Second street, to John Ritchie & Son.

Louisville, Ky.—Paving Fourth avenue with creosoted wood block, to Geo. W. Gosnell, $15,001.

Lake Charles, La.—Constructing 18,000 ft. of curb and 90,000 sq. ft. of sidewalk, to DeLatte & La Grange, of Lake Charles.

New Orleans, La.—Paving Carondelet street with asphalt, to the Barber Asphalt Co., Boston, Mass., $41,000; graveling Howard avenue, to Craven & Co., $3,624.

Baltimore, Md.—Paving construction, to the F. E. Schneider Paving Co., $48,928.

Baltimore, Md.—Constructing 2.6 miles of road, to George Jewell, $45,443.

Boston, Mass.—The following paving contracts have been awarded. Southampton street, to McGuire & Kiernan, $52,647; Stratford street, to the West Roxbury Trap Rock Co., $9,927; constructing macadam roadway on Morton street, to John Kelly Co., $10,000; laying wood block pavement, Northampton street, to the S. F. & A. B. Gore Corporation, $9,971; macadam roadway on Stratford street, to the West Roxbury Trap Rock Co., $9,927; paving Southampton street, to McQuire & Kiernan, $52,-647; constructing macadam roadway on Floyd street, to James Doherty, $3,433.

Batesville, Miss. — Constructing three miles of sidewalks, to P. T. Powers & Son, of Memphis, Tenn., about $10,000.

Brunswick, N. J.—Constructing new road at Highland park, to Thomas H. Riddle, of Brunswick, $53,333.

Flemington, N. J.—Constructing a macadam road between Clinton and Hampton, to M. I. Demarset, of Sewaren, N. J., $57,-252.

Kearney, N. J.—The following paving contracts have been awarded: Kearney avenue, to Van Keuren & Son, $60,281; paving Midland avenue, about 8,500 ft., to Van Keuren & Son.

Newark, N. J.—Improving Trenton ave-

nue, including 5,200 ft. of Telford pavement, to R. G. McManus, $13,380.

Rahway, N. J.—Paving Main street with brick, to the Jersey Paving Corporation, of Newark, $24,000.

Buffalo, N. Y.—Paving Huron street, to Henry D. Burgard Co., $15,050.

New York, N. Y.—The following street improvement contracts have been awarded: Paving Terrace View avenue, to the Harlem Contracting Co., 2 Rector street, New York, $10,316; section 2, of Terrace avenue, to the same, $4,505; improving Elwood street, to the Goodwin Construction Co., 30 Church street, New York, $6,549.

Bryan, O.—Improving the Bryan-Defiance road, to the Kelly Construction Co., of Bryan, $13,506.

Caldwell, O.—Paving New street, to Wilson & Harber, of Barnesville, O., about $11,000.

Columbus, O.—Improving three miles of roadway, to Radabaugh & Imbodin, of Logan, O., $12,390.

Lisbon, O.—Constructing 1.06 miles of brick paving, to Geo. B. Patterson, of Wellsville, O., $13,170.

Upper Sandusky, O.—Macadamizing two miles of road, to Carroll & Gruber, $12,769.

Palestine, O.—Paving 5,000 ft. of the Elkton road, to Geo. B. Patterson, of Wellsville, O., $13,172.

Bartlesville, Okla.—Paving contracts have been awarded as follows: To Plunkett & Yale, Coffeyville, Kan., $27,000; to Waltham, Hanna & Clark, $20,000; paving Osage avenue with bitulithic, to P. S. Kaull, American National Bank building, Kansas City, Mo., $34,000.

Hugo, Okla.—Constructing asphalt pavement, to the Shelby Downard Asphalt Co., of Ardmore, Okla., $125,000.

Portland, Ore.—The following paving contracts have been awarded: Front street with bitulithic, to the Warren Construction Company, $4,926; Jefferson street, to the same, $11,224; Woodward avenue, to the same, $855; East Seventh street, to the Oregon-Hassam Paving Co., $1,745; East Thirty-second street, to the Barber Asphalt Paving Co., $3,360.

Salem, Ore.—Paving McMinnville street, to the Warren Construction Co., of Portland, Ore., $120,000.

Greensburg, Pa.—Constructing extension of the Greensburg Country Club road with amiesite, to Chas. E. Eastburn, of Yardley, $20,360.

Monongahela, Pa.—Constructing 60,000 sq. yds. of brick pavement, to M. Erbeck, of Homestead, Pa.

Philadelphia, Pa.—The following paving contracts have been awarded: West Moreland street, $2,400, Cresson street, $2,300, Sixty-second street, $19,200, Walnut lane, $10,000, all to the Cunningham Paving and Construction Co.; paving Stonehouse lane, to James Irvin, $7,600; improving Crittenden street, to John Perrigan, $1,700.

Philadelphia, Pa.—Repaving Race street pier with wooden block to The Filbert Paving and Construction Co., Pennsylvania building, Philadelphia, $13,000.

Pittsburg, Pa.—The following street improvement contracts have been awarded: Paving Corday alley, to Booth & Flinn, $3,741; paving Wilkins street, to the same, $18,820; paving Haights Alley, to J. B. Sheets Co., $2,047; paving Herman street, to the Thomas Cronan Co., $6,605; paving Pamas street, to Ed O'Herron Co., $8,158; paving Charles street, to Booth & Flinn, $3,716.

Swissdale, Pa.—Street improvement contracts have been awarded as follows: To McGrady Bros., $48,000; E. J. Madigan Co., $8,000; The Prosser Contracting Co., $9,210.

Florence, S. C.—Constructing 40,000 sq. yds. macadam and bitulithic pavement, to the Atlantic Bitulithic Co., of Richmond, Va., about $50,000.

Memphis, Tenn.—The following concrete paving contracts have been awerded by the Speedway Land Co., 71 Madison avenue, Memphis: to D. S. Davies, $12,800; gravel roadway, to H. W. Brennan, $4,500.

Waco, Tex.—Constructing gravel roads, to Flannigan & Pritchett, of Waco, $100,000.

San Antonio, Tex.—Paving the main driveways of the capital, including about 12,500 sq. yds. of bitulithic, to the Texas Bitulithic Co., of Dallas, Tex.

Salt Lake City, Utah.—Constructing bitulithic paving on North Main street, to P. J. Moran, $38,825.

Salt Lake City, Utah.—Paving Fifth East street, to P. J. Moran, $95,849.

Portsmouth, Va.—Constructing curb and gutter and sidewalks on a number of streets, to Louis Lawson, of Norfolk, Va., $30,115.

Bellingham, Wash.—Paving Broadway, to the Independent Asphalt Co., $18,333.

MUNIC ENGR—SEVENTEEN

Colfax, Wash.—Constructing bitulithic paving on Main street and Mill street, to the Warren Construction Co., of Portland, Ore., $93,000.

Everett, Wash.—Improving road between Everett and Bothell, to the West Coast Construction Co., of Seattle, Wash., $21,802.

Madison, Wis.—Paving contracts have been awarded to the Andrews Asphalt Paving Co., of Hamilton, O., as follows: Langdon street, $19,475; Carroll avenue, $11,667.

CONTEMPLATED WORK.

Hillsborough, Cal.—The construction of eight miles of highway, probably oiled macadam, to cost $91,000, is contemplated. Haviland & Tibbetts, Alaska Commercial Bank building, San Francisco, Cal., engineers.

Oroville, Cal.—City Engineer Norris is preparing plans and specifications for the paving of a number of streets.

Santa Cruz, Cal.—The construction of a road between Santa Cruz and Watsonville, about 20 miles in length, is contemplated.

Wilmington, Del.—The construction of 188,000 sq. yds. of paving is contemplated. A. J. Taylor, city engineer.

Boise City, Ida.—Approximately 310,000 sq. yds. of asphalt, bitulithic or concrete pavement will be laid during 1912. Emily L. Savidge, city clerk.

Aledo, Ill.—The paving of the principal streets with Dolarway bitumen is contemplated.

Alton, Ill.—The construction of two miles of brick pavement is contemplated. J. P. Callahan, superintendent of public works.

Champaign, Ill.—The paving of Fifth street, about six blocks, is contemplated.

Decatur, Ill.—The city is contemplating the paving of North Jasper, East Williams and East Aves streets. Estimated cost, $48,275.

Mattoon, Ill.—Paving of a number of streets is contemplated. C. L. James, city engineer.

Peoria, Ill.—The paving of McClure avenue, for the distance of 1½ miles is contemplated.

Waukegan, Ill.—The paving of about five miles of street is contemplated.

Brazil, Ind.—Lewis township has voted to improve three roads as follows: With crushed rock road No. 1, 7,863 ft.; No. 2, 9,437 ft. and No. 3, 7,918 ft.

Terre Haute, Ind.—The commissioners of Parke and Vigo counties are contemplating the construction of a county road between the two counties, three miles in

length, and to be constructed of gravel. Nathan C. Wallace, county auditor of Vigo county.

Eldora, Ia.—The city is contemplating the paving of 22 blocks during the season of 1912.

Sheldon, Ia.—The paving of about 20 blocks of street early in the spring is contemplated.

Bridgeport, Mich.—The township has voted road improvement bonds for $20,000.

Houghton, Mich.—The construction of about four miles of macadam roadway is contemplated. R. Martin, engineer.

St. Joseph, Mich.—The Berrien county board of supervisors are contemplating road construction to cost $57,000.

Duluth, Minn.—City engineer has prepared plans and estimates for the paving of Railroad street with sand stone block.

Owaconna, Minn.—A $10,000 bond issue for the construction of pavements and sewers is voted.

Pawhuska, Okla.—Strike-axe township, in George county has voted road improvement bonds to the sum of $30,000.

Bay City, Ore.—The county commissioners are planning extensive road improvements.

Charleroi, Pa.—Washington county is contemplating the construction of about 35½ miles of road.

South Fork, Pa.—A $25,000 bond issue for the construction of pavement and roadways has been voted. O. P. Thomas, Johnstown, Pa., engineer.

Wilkes Barre, Pa.—District Engineer Arthur W. Long, of the state highway department, has been instructed to prepare plans for a road between Wilkes Barre and Scranton, Pa.

Loudon, Tenn.—A bond issue of $100,000 has been voted for road improvements.

Colfax, Wash.—Paving construction to cost about $60,000 is contemplated.

Wheeling, W. Va.—A $20,000 bond issue for the improvement of the road between Belaire and Bridgeport has been voted.

SEWERS.

BIDS REQUESTED.

St. Elmo, Ill.—P. E. Fletcher, city engineer, desires prices f. o. b. St. Elmo, on paving brick, grates for catch basins and sewer tile.

Ashtabula, O.—Nov. 28, 12 m. Constructing an outlet for street storm sewer. Includes 18-in. to 30-in. pipe sewer. A. J. Richardson, director of public service; A. B. Faulkner, clerk.

Pleasant Ridge, Hamilton County, O.—Dec. 16, 12 m. Constructing a sanitary sewer system and a sewage purification plant. Certified check, 5 per cent. H. B. Hayden, village clerk.

McKeesport, Pa.—Dec. 27, 7:30 p. m. Sewer construction as follows: 8-in. vitrified pipe sewer on Franklin avenue; 15-in. pipe sewer on Archer street; 8-in. sewer on Fawcett street. Bond, $3,000 on each bid. S. E. Soles, city controller.

Norristown, Pa.—Dec. 11. Constructing sewage disposal plant for town of 30,000 present population. F. Cameron Corson, borough engineer.

Neepawa, Man., Can.—Dec. 15, 8 p. m. Water works construction as follows: Contract A, laying water pipe and sewer; contract B, constructing pump house and filter room; contract C, constructing water power; contract D,, furnishing cast iron water pipe; contract E, furnishing gate valve, fire hydrant, etc.; contract F, furnishing and installing pumping machinery; contract H, constructing dam, intake and reservoir; contract M, constructing wood stave pipe; contract S, furnishing sewer pipe; contract W, laying conduit; contract X, constructing sewage disposal works. J. W. Bartley, secretary-treasurer. Chipman & Powers, Winnipeg and Toronto, engineers.

CONTRACTS AWARDED.

Osceola, Ark.—Constructing a sanitary sewer system and a disposal plant, to Roetzel & Chipman, of Osceola, Ark., $16,762.

Pine Bluff, Ark.—Paving West Barraque and West Pulles streets with creosoted wood block, to Shelby & Bateman, of Little Rock, Ark., $50,000.

Long Beach, Cal.—Constructing 26,000 ft. of sewer, to Watson & Spicer, $15,000.

Monrovia, Cal.—Constructing 26,000 ft. of sewer, to Watson & Spicer.

San Francisco, Cal.—Hauling and laying cast iron pipe for section B of the Ingleside outlet sewer, to the Coast Improvement Co., 68 Coast street, San Francisco, Cal.

Denver, Col.—Constructing sanitary sewer to the Westcott-Doan Investment Co., $27,785.

Summerville, Ga.—Constructing sewer system, to Guild & Co., of Chattanooga, Tenn., $11,000.

Payette, Idaho.—Constructing 16,700 ft. of 6-in. to 15-in. pipe sewers, to K. Sanset, of Corvallis, Ore., $18,908.

Chicago, Ill.—Constructing sewers on Wallace street, to Alphonso Scully, $19,200; constructing sewers on 37th street, to Alphonso Notordonato, $258.

Marsailles, Ill.—Constructing sewer extension, to Green & Son, of Ottawa, Ill., $51,158.

Princeton, Ill.—Constructing a sanitary sewer, involving 30,000 ft. of vitrified pipe construction, to the Hackworth Construction Co., of Appleton, Wis.

Fairfield, Ia.—Constructing sewer, to John Brogan, of Green Bay, Wis.; $70,160.

Baltimore, Md.—Constructing the Jones Falls trunk sewer system, to Fisher-Carozza Co., of Baltimore, $704,000.

Boston, Mass.—The following sewer contracts have been awarded: Constructing catch basins and drains in Brighton and Dorchester, to Murphy & Dolan, $2,275; widening and deepening channel at the Calf Pasture pumping station, to J. P. O'Riorden, $10,920.

Buzzards' Bay, Mass.—Constructing 60-in. cast iron outfall sewer, to Patrick McGovern, Boston, Mass., $68,909.

Kansas City, Mo.—Constructing section of the Brush Creek sewer, to Michael Walsh, $47,859.

Kansas City, Mo.—Constructing sanitary and storm sewers as proposed by Paul McGeehan, superintendent of sewer division, to Williams & Sanle, $46,958.

Kansas City, Mo.—Constructing the east division of the Brush Creek sewer, to R. V. & G. T. Brown, Kansas City, Kans., $111,360.

St. Louis, Mo.—Constructing the second section of the Rock Creek district sewer, to George B. Prendergast Construction Co., $154,834.

Dunkirk, N. Y.—Constructing sewer in Central avenue, to John H. Crowe, $11,916.

Glen Falls, N. Y.—Constructing sewer system in South Glen Falls, to Sherman & Blackburn, $33,745.

Rochester, N. Y.—The following sewer contracts have been awarded. East Side trunk sewer, to William H. Sours, $42,502; the Thomas creek and Blossom road storm sewer, to H. M. Cowles, $36,762.

Yonkers, N. Y.—The following sewer contracts have been let: Constructing a sewer in Bronx road, to Joseph L. Cuozzo, 176 Oak street, $16,643.

Youngstown, O.—Constructing sewer in sub-district No. 3, to Lewis Agagasio, of Youngstown, O., $28,804.

Pittsburg, Pa.—Furnishing pumping engine at the Aspinwall pumping station, to the Dravo-Doyle Co., Lewis Bldg., Pittsburg, Pa., $37,990.

Brownsville, Tex.—Constructing Cameron county drainage district No. 1, including excavation, bridges, flumes, etc., to N. E. Rendall, of Brownsville, Tex., $161,542.

Dallas, Tex.—Constructing storm sewer on Pennsylvania avenue, to J. W. Smith & Son, $34,912.

Parkersburg, W. Va.—Constructing sewer on Laird avenue, to The Cantrel Construction Co.

CONTEMPLATED WORK.

Turlock, Cal.—Sewer extensions, to cost $12,500, are contemplated.

Ansonia, Conn.—City engineer is preparing plans for a sewer system, which includes 14,551 ft. of pipe.

Chicago, Ill.—The extension of a sewerage system, to Cicero & Austin, to cost about $214,000, is contemplated.

Murphysboro, Ill.—City Engineer Ralph Rollo is preparing plans and estimates for the East Side sewer system.

Fort Wayne, Ind.—Plans have been prepared for sewer improvements, to cost $513,000.

Kendallville, Ind.—A sewerage system, to cost $18,000, is contemplated.

Girard, Kans.—Burns & McDonnell, of the Scarritt Bldg., Kansas City, Mo., are preparing plans and estimates for a sewage disposal plant, to cost about $30,000. Fred Gerkes, city clerk.

Morgan City, La.—An $80,000 bond issue for the construction of a water works and sewerage system has been voted.

erage system, to cost $20,000, in South Salem, is contemplated. P. J. Kelly, sewer commissioner.

Sedalia, Mo.—S. G. Leaming, Sedalia, Mo., is preparing plans for a sewerage system and a disposal plant, to cost about $75,000.

St. Joseph, Mo.—The city is contemplating the construction of sewers in three sewer districts. David Lawlor, city engineer.

Union, Mo.—A $10,000 bond issue for sewer extension has been voted. The Fuller Construction Co., Chemical Bldg., St. Louis, Mo., engineers.

Las Vegas, Nev.—Lewis C. Kelsey, Selling Bldg., Portland, Ore., has been retained to prepare plans for sanitary sewerage system, to cost about $40,000.

Beverly, N. J.—The construction of a sewerage system, to cost about $35,000, is contemplated.

Caldwell, N. J.—The construction of a sewage disposal plant, to cost $90,000, is contemplated.

Solvay, N. Y.—The state department of health has ordered the village to construct a sewage disposal plant.

Whitestone, N. Y.—The construction of a sewer on 5th avenue, to cost about $75,000, is contemplated.

Yonkers, N. Y.—A. J. Hartmann, engineer of the Bronx Valley sewerage commission, has prepared plans and specifications for extending the outlet of the Bronx Valley sewer 150 ft. Estimated cost, $70,000.

Clayton, N. C.—A bond issue for the construction of a water works, sewerage system and electric light plant has been voted.

Barberton, O.—Sewer extensions, to cost about $40,000, are contemplated. Construction will begin in the spring of 1912.

Canton, O.—A site for the proposed sewage disposal plant has been purchased.

Cleveland, O.—City Engineer Hoffman has estimated the cost of an intercetping sewer system, at $2,750,000.

Dayton, O.—The city is contemplating the construction of storm sewers in Dry Hollow creek, to cost about $100,000.

Salem, O.—A $55,000 bond issue for the construction of a sewage disposal plant has been voted.

Forest Grove, Ore.—Standard & Richardson, 410 Henry Bldg., Portland, Ore., are preparing plans for a sewerage system, to cost about $70,000.

Ambler, Pa.—James H. Gillin has prepared plans and specifications for a sewerage system, to cost about $90,000.

Scranton, Pa.—A $54,000 bond issue for the construction of three sewers has been voted.

Towanda, Pa.—Surveys for the construction of a sewage disposal plant are being made by H. M. Pickersdill, representing F. H. Shaw, of Elmira, N. Y.

Clarksville, Tex.—A bond issue for the construction of a sewerage system has been voted.

Coppenish, Wash.—A $50,000 bond issue for sewer construction has been voted.

LaCrosse, Wis.—The construction of sewer extension, to cost about $110,000, is contemplated.

Revina, Sask., Can.—A $150,000 bond issue for sewer construction has been voted.

WATER WORKS.

BIDS REQUESTED.

Piedmont, Ala.—Dec. 9. Constructing water works extensions and an electric light plant. Estimated cost, $25,000. City clerk.

Wilmington, Del.—Dec. 11, 10:30 a. m. Furnishing the following equipment for the water works department: Two vertical triplex, single-acting power pumps, discharging 2,000,000 gallons and 4,000,000 gallons, respectively, with water turbines, discharging 80,000,000 gallons and 40,000,000 gallons under 19-ft. head at 78 r. m. p. Bond, 50 per cent. John A. Kienle, chief engineer board of water commissioners.

Washington, D. C.—An American consular officer states that the construction of an electric power plant of 10,000,000 units yearly, for use in connection with the clarification of the water supply of the city, is contemplated. The water supply of the city is 15,000,000 gallons daily. The clarification plant must have a capacity to remove amber-colored vegetable matter from 1,000,000 to 5,000,000 gallons of water daily. Address Bureau of Manufacturers, No. 7618.

Rushville, Ill.—Dec. 4, 2 p. m. Water works construction as follows: Furnishing 2,400 ft. of 6-in., 500 ft. of 10-in. cast iron pipe; 23,700 ft. of 10-in. 75-lb. wood stave pipe, 3,300 ft. 10-in. 125-lb. pressure wood stave pipe; 1,300 lbs. special castings; 16 ft. by 20 ft. brick building; one 250-gal. per minute, horizontal, multi-stage turbine pump, direct connected to a 30-h.p. 220-volt motor; one 450-gal. per minute turbine pump, driven by a 30-h.p. internal combustion engine; one well, 22 ft. deep and 12 ft. in diameter; a 6,000-volt transmission line of 29,000 ft. in length. City clerk. Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., engineers.

Mason City, Ia.—Dec. 12, 8 p. m. Furnishing a pump of 3,000,000 gal. capacity, including condensers. J. H. McEwen, city clerk.

Loreauville, La.—Dec. 15. Constructing water works system, including tank and tower. City clerk.

Cleveland, O.—Dec. 6, 12 m. Constructing the West Side lake tunnel for the water department. A. B. Lea, director of public service. Ira O. Hoffman, clerk.

Muskogee, Okla.—Dec. 5, 10 a. m. Furnishing a 6,000,000-gal., horizontal, high-duty crank and flywheel pumping engine to operate against a 320-ft. head. Certified check, 10 per cent. E. H. Fleming, commissioner of water and sewers; E. P. Clonts,

city engineer. Alexander Potter, New York City, consulting engineer.

Vancouver, Wash.—Dec. 27. Furnishing the following equipment: 24,000 ft. of 24-in. steel pipe; valves for Seymour creek; pipe line extension; excavation and backfilling of pipe trench for 36-in. steel-riveted pipe. William McQueen, city clerk. Herman & Burwell, engineers.

Elma, Wash.—Dec. 5, 3 p. m. Water works construction as noted in Bulletin of Nov. 11. Louis Kelsey, 404 Selling Bldg., Portland, Ore., engineers. C. M. Long, Elma, Wash., town clerk.

Neepawa, Man., Can.—Dec. 15, 8 p. m. Water works construction as follows: Contract A, laying water pipe and sewer; contract B, constructing pump house and filter room; contract C, constructing water tower; contract D, furnishing cast iron water pipe; contract E, furnishing gate valve, fire hydrant, etc.; contract F, furnishing and installing mechanical filters; contract G, furnishing and installing pumping machinery; contract H, constructing dam, intake and reservoir; contract M, constructing wood stave pipe; contract S, furnishing sewer pipe; contract W, laying conduit; contract X, constructing sewage disposal works. J. W. Bartley, secretary-treasurer. Chipman & Powers, Winnipeg and Toronto, engineers.

CONTRACTS AWARDED.

Dorris, Cal.—Installing complete water works system, to Moore Bros., of Dorris, Cal., $12,400.

Mounds, Ill.—Laying mains and hydrants, to O'Shea & Hogan, of Cairo, Ill., $14,580.

Fairfield, Ia.—Constructing filter plant, to the Jewell Water Improvement Co., of Chicago, Ill., $16,000.

Hiawatha, Kans.—Extending the water works system, to the Des Moines Bridge and Iron Works, of Des Moines, Ia.

Mound City, Kans.—The following water works contracts have been awarded: Filter plant, to Pittsburgh Filter Manufacturing Co., Pittsburgh, Pa.; pumps, to the Kansas City Engineering Co., Kansas City, Mo.; distribution system, to Thorgmartin, Gardner & Martin, of Fort Scott, Kans.

Lowell, Mass.—Constructing a pumping station at water supply station, to Patrick O'Hearn, $20,000.

Baraga, Mich.—Contracts for installing a municipal water works and electric light plant have been awarded to the following contractors: The Central Combination Co., of Oshkosh; the National Meter Co., of Chicago, and the Electric Equipment Co., of St. Paul, Minn. The total amount of the contract is $28,676.

Minneapolis, Minn.—Furnishing equipment for the filtration plant, to the Pittsburgh Filter Co., Farmers Bank Bldg., Pittsburgh, Pa.

Amory, Miss.—Constructing water works and sewers, to Sullivan, Long & Hagerty, of Bessemer, Ala., $67,250.

Shelby, Neb.—Constructing water works system, to the Des Moines Bridge and Iron Co., of Des Moines, Ia., $12,868.

Wilcox, Neb.—Constructing a complete water works system, to the Des Moines Bridge and Iron Works, of Des Moines, Ia., $12,226.

Niagara Falls, N. Y.—Constructing filter plant, to the Dravo-Doyle Co., Lewis Bldg., Pittsburgh, Pa.; constructing sedimentation tanks, to Farrar & Trefts, Perry street, Buffalo, N. Y.

Charlotte, N. C.—Constructing nine miles of 24-in. pipe line and a filtration plant, to Enslinger Bros., Niles, O., about $100,000.

Oklahoma City, Okla.—The Western Wells Co., of Kiowa, Kans., has been awarded the contract to furnish the city 5,000,000 gallons of water per day at two cents per 1,000 gallons. A deep well system is contemplated.

Jellico, Tenn.—Constructing about six miles of water mains, to Howard Neely, of Mt. Pleasant, Tenn.; furnishing hydrant valves and boxes, to the Columbian Iron Works, of Chattanooga, Tenn.

Seattle, Wash.—Laying water main on Fourth avenue, South, to Sparger Concrete Co., 559 Coleman Bldg., $13,922.

CONTEMPLATED WORK.

Piedmont, Ala.—A $25,000 bond issue for the enlargement of the water works and the construction of an electric light plant, has been voted.

Fullerton, Cal.—The installation of a municipal water plant is contemplated. Address Robert Meyers.

Orange, Cal.—A $50,000 bond issue for water works construction has been voted.

Watsonville, Cal.—The construction of a municipal water works plant, to cost about $100,000, is contemplated.

Fowler, Col.—A $25,000 bond issue for the installation of a water works system has been voted.

Meridian, Conn.—Additions to the water works system, to cost $10,000, are contemplate. J. B. Walsh, water commissioner.

Washington, D. C.—The construction of a $10,000 pumping plant on Minnesota avenue is contemplated.

Gainesville, Fla.—G. H. Cairns is preparing plans for a water works system, to cost $40,000.

Chipley, Ga.—The J. B. McCreary Co., Empire Bldg., Atlanta, Ga., has been retained to prepare plans and estimates for a water works system, to cost about $20,000.

Claxton, Ga.—A $30,000 bond issue for electric light and water works plant has been voted.

Rome, Ga.—Additions to the water warks system, to cost $75,000, is contemplated. W. M. Wilson, city engineer.

Pocatello, Idaho.—A $270,000 bond issue for the acquisition or construction of a municipal water works system has been voted.

Oregon, Ill.—A. M. Abbott desires catalogue and information on water works equipment.

Peoria Heights, Ill.—A $10,000 bond issue for the construction of a water works system, the total cost of which will be $25,000, has been voted.

Rushville, Ill.—A bond issue of $31,000 for the improvement of the water works system has been voted. W. A. Fuller, St. Louis, Mo., consulting engineer. Howard F. Dyson, city engineer.

Sheridan, Ind.—The Sheridan Water, Light and Heat Co. has been incorporated for $100,000 by J. L. Vickery, Perley Weaver, J. A. Branson, J. G. Antrim and Fred Beauchamp.

Audubon, Ia.—A $26,000 bond issue for additional water works construction has been voted.

Fowler, Kans.—The construction of a water works system, to cost $15,000, is contemplated. Worley & Black, consulting engineers, Kansas City, Mo.

Pittsburg, Kans.—The city is contemplating the extension of the water distribution system. L. E. Curfman, city engineer.

Lexington, Ky.—J. M. Caird, of Troy, N. Y., has prepared plans for the construction of a concrete coagulating basin, to cost about $50,000.

Madisonville, Ky.—The city is contemplating the construction of a water works system, to cost about $75,000.

Haynesville, La.—The city is contemplating the construction of a water works system, to cost about $10,000.

Morgan City, La.—An $80,000 bond issue

for the construction of a water works and a sewerage system has been voted.

Quincy, Mass.—The city is contemplating water works construction, to cost $10,000. E. C. Sargent, city engineer.

St. Paul, Minn.—The water board has been given authority to issue bonds in the sum of $75,000 for extending the service mains.

Lamar, Mo.—A $70,000 bond issue for the construction of a water works and electric light plant is voted.

St. Louis, Mo.—The extension of the water works distribution system, to cost about $150,000, is contemplated. Maxine Reber, president board of local improvements.

Webster Grove, Mo.—A $75,000 bond issue for the extension of the water works system has been voted.

Gordon, Neb.—A $34,000 bond issue for the completion of the water works system has been voted.

Yerington, Nev.—A $30,000 bond issue for the installation of a municipal water plant has been voted.

Pembroke, N. H.—Dudley & Sawyer, 936 Elm street, Manchester, N. H., are preparing plans for municipal water works plant.

Argyle, N. Y.—A $12,000 bond issue for the establishment of a water works system has been voted.

Waterford, N. Y.—The construction of a filter plant, to cost about $50,000, is contemplated.

Yonkers, N. Y.—The purchase of a 10,000,000-gal. pump and the construction of two filter beds, to increase the water supply, has been authorized. Estimated cost, $175,000. Campbell Scott, chairman water supply commission.

Devils Lake, N. D.—The city is contemplating the installation of a municipal water plant, to cost $32,000.

Delaware, O.—A $20,000 bond issue for the construction of a water works system has been voted.

Navarre, O.—A $25,000 bond issue for the water works construction has been voted.

Worthington, O.—A $20,000 bond issue for the construction of a water works system has been voted.

Bartlesville, Okla.—Bartlesville Water Co. has been incorporated for $150,000 by Swahty, of Chicago, Ill., and John George and John C. Hughes, of Bartlesville.

Clinton, Okla.—A $55,000 bond issue for the construction of a park system and the driving of a deep well has been sold, and the improvements will be started at once.

Clustee, Okla.—A $20,000 bond issue for water works construction has been voted.

Inola, Okla.—A $19,500 bond issue for water works construction has been voted.

Kingfisher, Okla.—The Benham Engineering Co., 812 The American National Bank Bldg., Oklahoma City, Okla., is preparing plans and specifications for a water works and electric light plant, for which $30,000 bonds have been voted.

Talihina, Okla.—A $25,000 bond issue for the construction of a water works system has been voted.

Tulsa, Okla.—Extensions of the water works system, to include a concrete and brick pumping station, wells, electrically-operated pump, cast iron pipe, hydrants, 100-k.w. generator, two motors, two centrifugal pumps, etc., to cost about $100,000, is contemplated. C. H. Sands, superintendent of water works.

Carleton, Ore.—Stannard & Richardson, 410 Henry Bldg., Portland, Ore., are preparing plans for a water works system, to cost about $40,000.

Haines, Ore.—A $20,000 bond issue for water works construction has been approved.

Hood River, Ore.—A $37,250 bond issue for the installation of a water works system has been voted.

Bethlehem, Pa.—A bond issue of $175,000 for the installation of a water works system has been voted. R. E. Newmeyer, engineer.

Philadelphia, Pa.—The South Easton Water Co. will construct a reservoir of 4,000,000-gal. capacity.

Warren, Pa.—The city is contemplating the purchase of a water works system, at a cost of about $490,000.

Corpus Christi, Tex.—The city is contemplating a water works system, to cost $250,000.

Killeen, Tex.—A $16,000 bond issue has been voted for the construction of a water works system.

Lott, Tex.—A $14,000 bond issue for water works construction has been voted.

Marlin, Tex.—The purchase of the water works plant, at a cost of $16,500, is contemplated.

Saint Jo, Tex.—A $10,000 bond issue for water works construction has been voted.

Waco, Tex.—The city is contemplating water works extensions, to cost $250,000. N. Renskiold, Dallas, Tex., engineer.

Bellingham, Wash.—The city is contemplating the extension of the water works system, to cost about $60,000. H. A. Whitney, city engineer.

Centralia, Wash.—C. G. Atterbury has prepared plans and estimates for water works extension, to cost between $90,000 and $100,000.

Prosser, Wash.—A $50,000 bond issue for the construction of a water works system has been voted.

Fox Lake, Wis.—The Oscar Claussen Engineering Co., of St. Paul, Minn., has prepared plans and estimates for a water works system, to cost about $20,000.

Madison, Wis.—A $20,000 bond issue for extension of the water works system has been ordered.

Two Rivers, Wis.—Extensions to the municipal light and water plant, to cost about $25,000, are contemplated.

Victoria, B. C., Can.—Plans are being prepared by Wynn Meredith, consulting engineer, for water works extension, consisting of dams, storage reservoirs, conduits and pressure pipe for delivering 16,000,000 gal. of water per day from Sooke Lake, about 30 miles west of the city.

BRIDGES.

BIDS REQUESTED.

Jacksonville, Fla.—Dec. 6, 10 a. m. Bridge construction as follows: Reinforced concrete bridge; constructing 6-ft. corrugated iron culvert on New York avenue. Gail L. Barnard, county engineer.

Newcastle, Ind.—Dec. 5, 10 a. m. Constructing and repairing several bridges. W. L. Risk, auditor.

Petersburg, Ind.—Dec. 5, 2 p. m. Constructing five bridges. John D. Gray, auditor.

Preston, Ia.—Jan. 4, 1.30 p. m. Constructing county bridges during the year of 1912. Estimated cost, $15,000. Theodore S. DeLay, surveyor of Union county.

New Orleans, La.—Dec. 28, 11 a. m. Erecting a Strauss trunion bascule bridge, under ordinance No. 7444. Certified check, $1,000. Charles R. Kennedy, controller.

Vicksburg, Miss.—Dec. 5, 12 m. Flooring two bridges. J. B. Laughlin, clerk.

Fulton, N. Y.—Dec. 18, 8 p. m. Constructing a concrete steel bridge across the Oswego river, at Broadway. Certified check, $10,500. J. A. Foster, president board of public works.

Columbus, O.—Dec. 15, 12 m. Bridge construction as follows: Constructing reinforced concrete box culvert, engineer's estimate No. 344; constructing new floor system for a bridge, under engineer's esti-

mate No. 345. Certified check, $200 on each bid. F. M. Sayre, county auditor.

Toledo, O.—Dec. 5, 12 m. Constructing a 2-leaf "Rall" bascule bridge across the Maumee river at Cherry street. J. R. Cowell, director of public service; S. G. Stockton, secretary.

Davenport, Wash.—Dec. 6. Constructing six steel bridges. J. W. Brislawn, county auditor.

Davenport, Wash.—Dec. 7. Furnishing corrugated metal culvert. J. W. Brislawn, county auditor.

CONTRACTS AWARDED.

LaSalle, Ill.—Constructing eight bridges, to the Joliet Bridge and Iron Co., of Joliet, Ill.

Jasper, Ind.—Constructing bridge across White river at Portersville, to the Vincennes Bridge Co., of Vincennes, Ind., $16,444.

Jackson, Miss.—The following bridge contracts have been awarded: Pearl river bridge and Oakley bridge, to the Vincennes Bridge Co., of Vincennes, Ind.; the Learned bridge, to the Southern Bridge Co.

Kansas City, Mo.—Constructing an ornamental reinforced concrete bridge at Wormall road, to J. H. Stone, Reliance Bldg., Kansas City, Mo., $10,600.

Selina, O.—Bridge contracts have been awarded to the following firms: Brookville Bridge Co., of Brookville, O.; Croghan Construction Co., of Fremont, O.; H. B. Hughes, of Selina, O.; Behnert & Flaylor, of Burkettsville, O.

Shawnee, Okla.—Constructing steel bridge at Epontuschi, to the Kansas City Steel Bridge Co., of Kansas City, Mo.

Rock Hill, S. C.—Constructing two steel bridges, to the Roanoke Bridge Co., of Roanoke, Va.

Stillwater, S. C.—Constructing a steel bridge, to Austin Bros., of Atlanta, Ga., $9,026.

Selmer, Tenn.—The following bridge contracts have been awarded: Constructing an 85-ft. bridge over Cypress creek, to the Beach Manufacturing Co., of Pharlow, Mich.; constructing a 45-ft. steel bridge, to the Joliet Bridge and Iron Co., of Joliet, Ill.

Angleton, Tex.—Constructing two steel bridges across the Brazos river, to the Midland Bridge Co., of Kansas City, Mo., $100,000. Francis F. Rite, Sweeney, Tex., engineer.

Gonzales, Tex.—Constructing two steel bridges, one across Peach creek and the other across Benton creek, to the Gonzales Bridge and Iron Co., of Gonzales, Tex.

Norton, Va.—Constructing 26 bridges, to the Roanoke Bridge Co., of Roanoke, Va., $23,350.

CONTEMPLATED WORK.

Lake City, Ark.—The construction of a bridge, to cost about $50,000, spanning the St. Francis river, is contemplated.

Sacramento, Cal.—Yolo county is contemplating the construction of about 50 concrete bridges.

Boise, Idaho.—The county commissioners will advertise for bids for the construction of an 80-ft. bridge over Indian creek.

Council Bluff, Ia.—The city engineer has been instructed to prepare plans and estimates for a concrete bridge on North Main street.

Des Moines, Ia.—Plans for a bridge across the Des Moines river, at North street, to cost about $100,000, has been ordered.

Orono, Maine.—A steel bridge, to cost about $30,000, will be erected by the town of Orono and the Bangor Railway and Electric Co.

Hackensack, N. J.—The construction of a bridge across the Hackensack river, to cost $150,000, is contemplated. R. Earle, Jr., county engineer.

Fulton, N. Y.—The construction of a concrete bridge at Broadway, to cost $80,000, is contemplated.

Wilmington, N. C.—The construction of a steel bridge over the North East river, to cost about $35,000, is contemplated. Commissioners of New Hanover and Pender counties.

Muskogee, Okla.—A $10,000 bond issue, voted by the town of Haskell and the township of Gatesville for the construction of a bridge across the Arkansas river, has been approved. Charles Bagg, attorney.

Phoenixville, Pa.—The county commissioners of Chester and Montgomery counties have decided to construct a bridge across the Schuylkill river.

Kamloops, B. C., Can.—Plans have been prepared for the construction of a new highway bridge across the South Thompson river.

STREET LIGHTING.

BIDS REQUESTED.

Chicago, Ill.—The Dearborn Street Improvement Association will install 140 ornamental lights along Dearborn street. About $50,000 is available. John C. Roth, president; John C. McCord, Adams Express Bldg., Chicago, Ill., secretary.

Corydon, Ia.—Dec. 5. Constructing an electric light plant, including boilers, engines, generators and all electrical equipment. J. J. C. Bower, town clerk. Iowa Engineering Co., Clinton, Ia., engineers.

Enfield, N. C.—Dec. 6, 8 p. m. Constructing an electric light plant. W. T. Clement, mayor. C. E. Fairbanks, 417 American National Bank Bldg., Richmond, Va., engineer.

Santo Domingo—Dec. 15. The American vice-consul general at Santo Domingo has forwarded specifications, calling for bids for the installation of a complete electric light plant. Address Bureau of Manufacturers, No. 7596.

CONTRACTS AWARDED.

Marshallville, Ga.—Constructing water works and electric light plant, to J. P. Walker.

Muskegon, Mich.—A ten-year lighting contract has been granted to the Grand Rapids-Muskegon Power Co. at $57.50 for arc lights and $16 for 60-c.p. incandescent.

CONTEMPLATED WORK.

Piedmont, Ala.—A $25,000 bond issue for the enlargement of the water works and the construction of an electric light plant has been voted.

Claxton, Ga.—A $30,000 bond issue for electric light and water works plant has been voted.

Beardstown, Ill.—The construction of a municipal light plant is contemplated.

Galena, Ill.—The Interstate Light and Power Co. is contemplating the installation of an ornamental lighting system.

Oregon, Ill.—A. M. Abbott wishes catalogue and information regarding street lighting.

Streator, Ill.—The city is contemplating the installation of an ornamental lighting system.

Angola, Ind.—An ornamental street lighting system is contemplated.

Bouton, Ia.—Constructing electric light and power station, to the Jones Electric Co., of Perry, Ia.

Glidden, Ia.—A $10,000 bond issue for

the construction of an electric light plant has been voted.

Jewell, Ia.—The installation of an ornamental street lighting system is contemplated.

Stony City, Ia.—The city is contemplating the installation of an ornamental lighting system. Address secretary Commercial Club.

Houghton, Mich.—The city is contemplating changing the lighting system to flaming arcs.

Mt. Clemens, Mich.—The lighting of the streets with gas is contemplated.

King City, Mo.—The city has voted to install a municipal light plant.

Kearney, Neb.—The city is contemplating the construction of a municipal lighting plant and an ornamental lighting system.

Chipewa, N. Y.—The Business Men's Association is experimenting with a better type of street light.

Little Falls, N. Y.—The city is contemplating the construction of a municipal light plant. Mathew A. Leahy, city clerk.

Oswego, N. Y.—The city is contemplating the installation of an ornamental lighting system in the business district.

Rochester, N. Y.—The installation of an ornamental lighting system is contemplated by the residents of South Fitzhugh street. Joseph E. Putman, city electrician.

Cleveland, O.—A $2,000,000 bond issue for the construction of a municipal electric light plant has been voted.

Kingfisher, Okla.—The Benham Engineering Co., 812 American National Bank Bldg., Oklahoma City, Okla., is preparing plans and specifications for a water works and electric light plant, for which $30,000 bonds have been voted.

Muskogee, Okla.—The Tahlequah Gas and Power Co. has been incorporated for $25,000, by D. M. Luteman, H. P. Woods and David Parr.

Ponca City, Okla.—A $30,000 bond issue for a municipal electric light and power plant has been voted.

Eugene, Ore.—A $25,000 bond issue has been sold for the purpose of installing an ornamental lighting system.

Del Rio, Tex.—The City Ice and Electric Co. has been incorporated with a capital stock of $40,000, by C. D. Foulke, W. H. Wolff and J. A. Farnam.

Aberdeen, Wash.—The installation of several new arcs and tungsten lights is contemplated.

Colfax, Wash.—The installation of a number of street lights is contemplated.

Ellensburg, Wash.—The installation of an ornamental lighting system on six streets is contemplated.

Sultan, Wash.—The city clerk has been directed to advertise for bids on ornamental lighting system.

Sunnyside, Wash.—The installation of 7½-ampere magnetite lamp for street lighting purposes is contemplated.

Victoria, Wash.—The city is contemplating the installation of a cluster of lighting system.

Manitowoc, Wis.—A $40,000 bond issue for light and water works improvement has been voted.

Two Rivers, Wis.—Extensions to the municipal light and water plant, to cost about $25,000, are contemplated.

FIRE APPARATUS.

BIDS REQUESTED.

Pasadena, Cal.—Dec. 5, 10:30 a. m. Furnishing one motor propelled automobile fire engine and hose wagon, and one motor propelled automobile chemical engine and hose wagon. Herman Dyer, city clerk.

Moose Jaw, Sask., Can.—Dec. 4, 8 p. m. Furnishing one fire department pumping engine of 800 to 850 gallon per minute capacity. W. S. Heal, city clerk.

CONTEMPLATED WORK.

New Decatur, Ala.—The city is contemplating the purchose of an automobile fire engine, to cost about $5,000.

Orange, Cal.—A $5,000 bond issue for the purchase of fire equipment has been voted.

New London, Conn.—The purchase of a motor fire engine to cost about $6,500 has been recommended.

West Palm Beach, Fla.—A $6,000 bond issue for the purchase of fire equipment has been voted.

Sumter, Ga.—The city has voted to purchase an auto fire engine for the local fire department.

Oregon, Ill.—A. M. Abbott desires information on auto propelled fire apparatus.

Shreveport, La.—A $50,000 bond issue for the erection of fire station and the purchase of equipments has been voted.

Brockton, Mass.—The sum of $5,500 has been provided for the purchase of an automobile chemical engine.

Fitchburg, Mass.—The city is contemplating the purchase of motor fire apparatus.

Somerville, Mass.—The city is contemplating the addition of an automobile fire engine, which will be purchased early in 1912.

Taunton, Mass.—A loan of $5,500 for the purchase of an automobile fire truck has been voted.

Massillon, O.—An ordinance authorizing a bond issue of $8,000 to transform two of the horse-drawn combination chemical engines into automobile apparatus has been voted.

Newport, O.—The purchase of an automoblie chemical engine for the fire department is contemplated.

Zanesville, O.—The city is contemplating the purchase of a motor fire engine.

Braddock, Pa.—The borough is contemplating the purchase of two automobile fire trucks; one to be a combination hook and ladder and the other a hose truck.

West Chester, Pa.—A $46,000 bond issue for sewer construction has been sold.

Terrell, Tex.—The city commission is contemplating the purchase of an automobile fire engine to cost about $7,500.

Wheeling, W. Va.—The city is contemplating the purchase of an automobile fire engine.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Indianapolis, Ind.—Dec. 6. Collecting and disposing of garbage from May 26, 1912. Bids for one and six year periods asked. C. A. Schrader, president board of public works.

Boston, Mass.—Dec. 5, 12 m. Disposing of refuse for a term of 10 years from July 1, 1912. Certified check, $10,000. Bond, $100,000. Louis K. Rourke, commissioner of public works.

CONTEMPLATED WORK.

Atlanta, Ga.—The city is contemplating additional crematory service other than is provided by a $50,000 bond issue recently voted.

Newport, Ky.—A $20,000 bond issue for the construction of a garbage disposal plant has been voted.

Monongahela, Pa.—A $10,000 bond issue for the construction of a garbage plant has been sold.

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AND MANY INQUIRIES

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